JOINT TECHNICAL COORDINATING GROUP ON AIRCRAFT SURVIVABILITY (JTCG/AS)

BIBLIOGRAPHY OF JOINT AIRCRAFT SURVIVABILITY REPORTS

JULY 2000

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Arlington, VA 22202

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This bibliography contains abstracts of published JTCG/AS reports and related documents. It is referenced by title and is organized by JTCG/AS Subgroup by year of publication. It is indexed by document number and by document title. This issue supersedes all previous issues. A copy may be obtained from the JTCG/AS Central Office.

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REPORT JTCG/AS-00-D-002

JOINT TECHNICAL COORDINATING GROUP ON AIRCRAFT SURVIVABILITY (JTCG/AS)

BIBLIOGRAPHY OF JOINT AIRCRAFT SURVIVABILITY REPORTS

JULY 2000

CONTENTS

INTRODUCTION AND INSTRUCTIONS

INTRODUCTION

This bibliography is published by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) Central Office. The Joint Aeronautical Commanders Group (JACG) chartered the JTCG/AS. The JTCG/AS organization is depicted on page 3. The purpose of this document is to provide a listing of technical reports, which have been published under the auspices of the JTCG/AS. This bibliography contains abstracts which are organized by date of publication for publications produced by the three principal subgroups; Susceptibility Reduction, Vulnerability Reduction, and Survivability Methodology. Administrative support publications, aircraft battle damage repair publications and publications pertaining to aircraft survivability but not funded by the JTCG/AS are also included. An index for each of these areas is provided following the collection of abstracts.

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Any documentation effort funded wholly or in part with JTC/GAS funding falls within the publication guidelines provided herein. They are:

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2. The final document will credit the responsible Government organization(s), the JTCG/AS and Contractors, when used. This information, plus a JTCG/AS technical publication number, which are assigned by the JTCG/AS Central Office, will be included on the SF-298.
3. The cover of the document will follow the design of the cover of this document. JTCG/AS logos may be obtained from the JTCG/AS Central Office.
4. Parent organizations normally assign their own report number and provide for a review process within their own organization. In addition, JTC/GAS Subgroup Chairmen will provide guidance for document review and approval within the Subgroup.
5. Documentation standards in effect for the parent service (of the person sponsoring the report) will suffice for the JTCG/AS standard.
6. Documentation distribution will include the JTCG/AS Central Office (1 copy), SURVIAC (1 copy) and DTIC (2 copies) in addition to the distribution required by the cognizant sponsoring engineer and his subgroup chairman, and the JTCG/AS Central Office staff member for that subgroup.

INSTRUCTIONS FOR REQUESTING PUBLICATIONS

JTCG/AS publications are special purpose documents initially issued from a distribution list. Activities not receiving these publications by initial distribution may request a copy from the Survivability/Vulnerability Information Analysis Center (SURVIAC) at:

SURVIAC
AFRL/VACS/SURVIAC
Bldg 45, 2130 Eigth Street, Suite 1
Wright-Patterson Air Force Base, OH 45433-7542

Phone: (937) 255-4840
Fax: (937) 255-9673

REQUESTING INITIAL DISTRIBUTION OF JTCG/AS REPORTS

Due to the nature of most of the technical reports produced by the JTC/GAS, a widespread distribution list is neither necessary nor desired. Therefore, a standard distribution list for JTCG/AS publications does not exist. Each publication is distributed based on its content and requirements known to the sponsoring government engineer, his subgroup chairmen and the JTCG/AS Central Office in that order. Classified publications are distributed based on established need to know. Unclassified SF-298's will accompany all publications. The JTCG/AS Central Office will maintain the Survivability Specialists Data Base which will be considered when individual report distribution lists are constructed.

Aircraft Survivability Projects Bibliography
(Documentation Listed by Report Number)

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(Documentation Listed by Report Number)

Report No.:
JTCG/AS-00-S-007
N/A

Report Classification:
Unclassified

Title: Digital Radio Frequency Memory Specifications Validation

Issued: 5 OCT 1999 FINAL

Sponsor:
George Gonczy
AFRL/SNRW Bldg 620
2241 Avionics Circle RM N3F10

Performing Organization:
Raytheon Technical Services Company
6125 E. 21st Street
Indianapolis, IN 46219-2058

Author(s):
N/A

Abstract:

The design of a Digital Radio Frequency Mewmory (DRFM) board using a Field Programmable Gate Array (FPGA) is described. It is an FPGA based DRFM with dual 8 bit Analog-to-Digital (A/D) inputs and dual 10 bit Digital-to-Analog (D/A) outputs as well as 80 bits of digital Input/Output (I/O). User defined switches and Light Emitting Diode (LED) indicators, 4 each, are provided. Maximum flexibility and reconfigurability is achieved by routing all external I/O throguh the FPGA. A Zero Insertion Force (ZIF) socket allows for the use of Xilinx FPGA devices in the 4000 and Virtex families. The Virtex series is especially suited to DFRM applications since it has dedicated blocks of Dual Port Random Access Memory (DPRAM). The oscillator is socked thus allowing the user to select his own sample rate, which can be in the range of 25 to 125 Mega Samples Per Second (MSPS). The board is intended for experimenting with DRFM bandwidths up to 100 MHz for In-phase and Quadrature (I-Q) and up to 50 MHz for real inputs (dual DRFM capability with real input). Anti-aliasing filltering must be done externally. The large gate capacity of the FPGA allows for including techniques generation functionality as well.

Report No.:
JTCG/AS-00-S-006
AFRL-SN-WP-TR-A999-1117

Report Classification:
SECRET/NOFORN

Title: New Laser Beamrider Missile Countermeasure Concepts (U)

Issued: September 1999 Final Report 4/20/12998 - 08/31/1999

Sponsor:
Sensors Directorate, Air Force Research Laboratory, AFMC
AFRL/SNJW
2241 Avionics Circle, Ste 2
WPAFB, OH 45433-7304

Performing Organization:
Lockheed Martin Tactical Defense Systems
1210 Massillon Road
Akron, OH 44315-0001

Author(s):
William Lappert, Dr. Gordon Schmidt, Dr. Stavros Androulakakis

Abstract:

(U) The concept of a destructive expendable as a means of aircraft self-protection is partially tested. Static warhead arena tests and dynamic live-fire tests are performed against threat missiles to examine the effectiveness of small blast/frag warheads against anti-aircraft missiles.

JTCG/AS BIBLIOGRAPHY

Report No.: **Report Classification:**

JTCG/AS-00-S-001 **SECRET**

Title: Active Core Exhaust Control (ACE) Phase II CRAD Threat Analyses Progress Report

Issued: March 1999 Final

Sponsor:

Performing Organization:
The Boeing company
Airlift and Tanker Programs
2401 E. Wardlow Road
Long Beach, CA 90807-5309

Author(s):
Roger Honacki

Abstract:

(U) This report summarizes the result of an AFRL/Boeing Research and Development Project. This report documents progress toward quantifying the potential survivability improvement offered by the ACE technology. This technology pulses air at a high pressure into the sides of the engine core exhaust flow to mix the core and fan exhaust streams. Simulation results indicate increased survivability against IR threats.

Report No.: **Report Classification:**

JTCG/AS-00-M-003 **Unclassified**

SURVIAC TR-00-03

Title: Expansion of the Component Vulnerability Analysis Archive

Issued: July 2000 Final January 1998 - July 2000

Sponsor:
JTCG/AS Central Office
1213 Jefferson Davis Highway, Suite 1103
Arlington, Virginia 22202-0000

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 colonel Glenn Highway, Suite 131
Dayton, Ohio 45431

Author(s):
Bennett, Gerald (SURVIAC)

Abstract:

One of the most critical and debated inputs to the nonnuclear vulnerability analysis process is an estimate of the probability of kill given a hit (Pk/h). The Pk/h value is unique to each target design since it is a function of both the componenet response and the response of the target given that component response. For example, loss of thrust of a turbofan engine can result in the loss of a single engine aircraft, but may not result in the loss of a multi-engine aircraft.

This Pk/h function can thus be defined as the product of two probabilities; the probability of component damage given a hit (Pd/h or Pcd/h) and the probability of achieving the defined target kill given that component damage (Pk/d). The Pk/d function is unique to the component installation in the target, while the Pd/h (or Pcd/h) is a function of the component design.

Since the Pd/h (or Pcd/h) is dependent on the component construction, estimates can be made for specific component designs and used in analyses of their installation in various targets. In order to archive these component vulnerability data and the associated methodologies the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) and the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) initiated the Joint Componenet Vulnerability Project (JCVP). As part of the JCVP, a Component Vulnerability Analysis Archive (CVAA) computerized database program was developed. This effort was to populate the CVAA with data and methodology on critical system data and analyses for aerial and ground targets.

This report documents the collection and incorporation of added data and methodologies into the CVAA and the associated "lessons learned" during this population effort.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-00-M-002
N/A

Report Classification:
Unclassified

Title: Accreditation Support Package for Airborne Radar Detection and Evaluation Simulation (AIRADE)(ASP-I) (U)

Issued: 5 June 2000 Draft 2000

Sponsor:
Naval Air Systems Command
Air 4.1.8. (JTCG/AS)
1725 Jefferson Davis Highway
Arlington, VA 22202-4102

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center Weapons Division
Code 4181000D, China Lake, California 93555-6001

Author(s):
Dianne Rindt, et al

Abstract:

This document is Volume 1 of the Accreditation Support Package (ASP-I) for the Airborne Radar Detection and Evaluation (AIRADE) simulation, v.7.4. ASP-I is designed to provide information on the current status of AIRADE, with respect to its general acceptability for use. The objective of this volume is to provide the information required to characterize the model well enough to provide an initial determination of its suitability for a particular application. It is also intended to provide enough information for the reader to determine whether the model is managed and supported well enough to yield consistent results across its spectrum of users and applications.

The information provided to characterize the AIRADE model consists of the following elements: 1) A description of the configuration management (CM) baseline for the model, including version history, current version status, model development policy, documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model; 2) A summary of assumptions and limitations inherent in the model; and 3) a review of the model's V&V and usage histories, as well as a summary of prior accreditations. The degree to which each information element is complete and current provides a general indication of whether the model is suitable for further consideration for use in a particular application.

Report No.:
JTCG/AS-00-M-001
SURVIAC TR-00-001

Report Classification:
Unclassified

Title: Collection and Incorporation of System Pcd/h Data and Methodology Into the Component Vulnerability Analysis Archive

Issued: February 2000 Final January 1999 - February 2000

Sponsor:
NAWCWPNS, CODE 418100D
1 Administration Circle
China Lake, CA 93555-6100

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 Colonel Glenn Highway, Suite 131
Dayton, Ohio 45431

Author(s):
Bennett, Gerald (SURVIAC)

Abstract:

One of the most critical and debated inputs to the nonnuclear vulnerability analysis process is an estimate of the probability of kill given a hit (Pk/h). The Pk/h value is unique to each target design since it is a function of both the component response and the response of the target given that component response. For example, loss of thrust of a turbofan engine can result in the loss of a single engine aircraft, but may not result in the loss of a multi-engine aircraft.

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Since the Pd/h (or Pcd/h) is dependent on the component construction, estimates can be made for specific component designs and used in analyses of their installation in various targets. In order to archive these component vulnerability data and the associated methodologies the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) and the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) initiated the Joint Component Vulnerability Program (JCVP). As part of the JCVP a Component Vulnerabiltiy Analysis Archive (CVAA) computerized database program was developed. This effort was to begin to populate the CVAA in the area of propulsion system data and analyses for aerial and ground targets.

This report documents the procedures developed for review and selection of data and the associated "lessons learned" during this initial population effort.

Report No.:
JTCG/AS-00-D-002

Report Classification:
Unclassified

Title: JTCG/AS Bibliography of Joint Aircraft Survivability Reports and Related Documents

Issued: July 2000 Final - 1975 through June 2000

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Hwy
Arlington, VA 22202

Author(s):
James A. Buckner, compiler

Abstract:

This bibliography contains abstracts of published JTCG/AS reports and related documents. It is referenced by title and is organized by JTCG/AS Subgroup by year of publication. It is indexed by document number and by document title. This issue supersedes all previous issues. A copy may be obtained from the JTCG/AS Central Office.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-00-D-001

Report Classification:
UNCLASSIFIED

Title: Joint Technical Coordinating Group on Aircraft Survivability Organizational & Specialists Directory

Issued: May 2000 Final 1999-2000

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Author(s):

Compiled by James A. Buckner, SRS Technologies, Inc.

Abstract:

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) annually publishes this directory of members of the JTCG/AS organization and of government and industry specialists in the aircraft survivability design discipline. This directory is intended to be a desk reference for the specialists themselves in the coordination of aircraft survivability programs and information . No effort is made to validate or verify the claimed specialties provided by the individuals listed. The data base for this directory is maintained at the JTCG/AS Central Office. Changes are made when received during the year and a copy of the data base record is distributed to each individual at year end for update purposes.

This update 2000 started with 384 records. During the update 63 were deleted, 175 were changed, 151 had no change, and 65 new records were added resulting in a new record count of 386 records.

Report No.:
JTCG/AS-99-D-001

Report Classification:
UNCLASSIFIED

Title: Joint Technical Coordinating Group on Aircraft Survivability Organizational & Specialists Directory

Issued: April 1999 Final 1998 - 1999

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Author(s):

Compiled by James A. Buckner, SRS Technologies

Abstract:

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) annually publishes this directory of members of the JTCG/AS organization and of government and industry specialists in the aircraft survivability design discipline. This directory is intended to be a desk reference for the specialists themselves in the coordination of aircraft survivability programs and information . No effort is made to validate or verify the claimed specialties provided by the individuals listed. The data base for this directory is maintained at the JTCG/AS Central Office. Changes are made when received during the year and a copy of the data base record is distributed to each individual at year end for update purposes.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-V-002
SURVIAC TR 99-011

Report Classification:
SECRET NOFORN

Title: (U) MANPADS Threat to Aircraft: A Vulnerability Perspective

Issued: June 1999 Draft Report 5 Aug 98 - 30 April 99

Sponsor:
Air Vehicles Directorate
Air Force Research Laboratory
Air Force Material Command
Wright-Patterson Air Force Base, OH 45433-7542

Performing Organization:
AFRL/VACS Bldg 63 and AFRL/VACS/SURVIAC Bldg 45
Wright-Patterson AFB, OH 45433-7605

POC: Greg Czarnecki, AFRL/VACS

Author(s):
Dr. Kristina Langer, Dr. Jeffrey Calcaterra, Gregory Czarnecki, Lt Stephanie Masoni (AFRL); Kevin Crosthwaite, Gerald Bennett (SURVIAC); David Legg (SURVICE Eng.)

Abstract:

(U) Man-Portable Air Defense Systems (MANPADS) are arguable the most effective and economic antiaircraft weapon system available. As such, these systems are proliferated worldwide and are the weapon of choice by third World countires, guerilla units, and terroist groups. The infrared (IR) MANPADS threat increasingly inpacts worldwide military planning and operations. During recent conflicts, the highly mobile, hard-to-detect, and difficult-to-counter MANPADS often produced the majority of aircraft kills. This report reviews MANPADS lethality and identifies the potential for economical vulnerability reduction solutions to assure aircraft survivability. The report documents data gathered and analyses performed concerning aircraft-MANPADS interactions. MANPADS are demonstrated to have many unique advantages and control a vast amount of airspace. MANPADS are capturing an ever-increasing portion of battlespace, severely limiting low-altitude daytime flight operations and ultimate mission successes. Manual vulnerability assessments on fighter, transport, and helicopter systems are provided. While hits do not necessarily llelquate to kills, a high probability of kill is associated with a general lack of MANPADS-capable vulnerability features. Several MANPADS-specific aircraft survivability solutions are brought to bear. New and innovative solutions include notions of directing approaching IR missiles to least vulnerable areas and specially-designing structure to prevent warhead fuzing. The underlying message is that vulnerability reduction features contribute to overall aircraft survivability and casualty reduction. By designing in a proper mix os susceptibility reductions and vulnerabiltiy reduction features, aircraft are provided with an optimal level of survivability at the lowest possible cost.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-V-001
SURVIAC TR-99-006

Report Classification:
Unclassified

Title: National MANPADS Workshop: A Vulnerability Perspective Proceedings, Volume

Issued: December 1998 Final, 15 - 17 December 1998

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability
1213 Jefferson Davis Highway, Suite 1103
Arlington, VA 22202

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 Colonel Glenn Highway, Suite 131
Dayton, Ohio 45431

Author(s):
Not Applicable

Abstract:

This report documents the proceedings of the National MANPADS Workshop: A Vulnerability Perspective. Workshop objectives were to 1) gather and exchange information concerning aircraft-MANPADS encounters, 2) compile a roadmap of current MANPADS vulnerability reduction activities, and 3) identify MANPADS-capable vulnerability reduction solutions. Rotorcraft, fighter, and large transport aircraft were addressed in the workshop. These proceedings are being published in two volumes. Volume I contains the unclassified briefings and Volume II contains all classified briefings.

Report No.:
JTCG/AS-99-S-001
TR-99-AMCOM-R241-226

Report Classification:
SECRET/NOFORN

Title: A Study of Foreign Imaging Infrared (IIR) Processing Algorithms with Application to Anti-Air Seekers

Issued: Sept 1999 Final 26 Feb - 30 Sep 1999

Sponsor:
Commanding Officer
Naval Research Laboratory (Dr. Frank Barone)
4555 Overlook Ave.
Washington D.C. 20375

Performing Organization:
Dynetics, Inc.
P.O. Box 5500
Huntsville, AL 35814

Commander AMCOM
AMSAM-RD-MG-IR (Attn: Frank Hayes)
REDSTONE ARSENAL, AL 35898

Author(s):
James Dawson, Keith Olree, Beth Lassiter, Sean Townsend - Dynetics, Inc.
Frank Hayes - U.S. Army Aviation & Missile command

Abstract:

(U) A survey of classified and unclassified foreign sources was conducted to identify key algorithms being developed for use in imaging infrared anti-air missile seekers. Algorithms were grouped as either acquisition and midcourse or terminal tracking. Forty algorithms were ranked with analysis and descriptions parovided for the top 5 ain each grouping.

Report No.:
JTCG/AS-99-M-010
SURVIAC TR 99-001

Report Classification:
Unclassified

Title: BLUEMAX IV, Release 1.0 User's Manual Aircraft Flight Path Generator and Mission Performance Evaluation Model

Issued: 1 June 1999 Final Report May 1998 - June 1999

Sponsor:
ASC/ENM, Bldg 146
2180 Eight St., Ste 1
Wright-Patterson AFDB, OH 05433-7505

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 Colonel Glenn Hwy, Suite 131
Dayton, OHG 45431-1662

Author(s):
Michael G. Bennett, Stephen H. Ames

Abstract:

This document is the User's Manual for the BLUEMAX IV program which provides information and instructions enabling the user to run the model. BUEMAX IV is an aircraft flight path generator and mission performance evaluation computer model. It generates a description of an aircraft's flight status at user-defined time intervals. The model can output these data in numerous formats suitable for input into graphics packages and other models such as ALARM, ESAMS, and RADGUNS. The user controls the aircraft flight profile by either interactively entering commands or preparing a set of automated commands in an input scenario file. Flight profiles can be made over flat earth or over Digital Terrain Elevation Data (DTED) generated by the National Imagery and Mapping Agency (NIMA). BLUEMAX IV Release 1.0 is an upgrade from the March 1997 release of BLUEMAX III Version 2.0 and includes many new features including aerodynamic enhancements, an enhanced command set, new output file types, and the new EAR terrain module (in FORTRAN 90) which allows terrain processing on both UNIX and PC architectures.

Report No.:
JTCG/AS-99-M-006

Report Classification:
Unclassified

Title: JTCG/AS ESAMS, ALARM and RADGUNS (EAR) Common RF Environment (CE) Modeling Component Set Version Description Document (VDD)

Issued: 1 November 1999 Final

Sponsor:
Information Directorate
Air Force Research Laboratory AFMC
Wright-Paterson Air Force Base, OH 45433-7334
POC: Russ Nourse (AFRL/IFSD) (937) 255-4429

Performing Organization:
Science Applications International Corporation
4031 colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esten, Paul Hannen, John Laugenderfer, Elaine Musick, Mike Sutton

Abstract:

This document describes the modifications made to ESAMS, ALARM and RADGUNS COMMON ENVIRONMENT (EARCE) versions 2.0 and 2.1 software. In EARCE v2.1, the Propagation and the Antenna Pattern sub-components were modified. In v2.0 EARCE was redesigned to be object-based. The sub-components enhanced include Atmospheric Attenuation, the Antenna, Clutter Reflectivity, Propagation (Multipath & Diffraction), Refraction and Terrain. It also gives software and hardware requirements.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-M-005
None

Report Classification:
Unclassified

Title: Interface Requirement Specifications (IRS) for the ESAMS, ALARM, and RADGUNS (EAR) Common Environment Modeling Component Set (CEMCS)

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
Air Force Research Laboratory AFMC
Wright-Paterson Air Force Base, OH 45433-7334
POC: Russ Nourse (AFRL/IFSD) (937) 255-4429

Performing Organization:
Science Applications International Corporation
4031 colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esten, Paul Hannen, John Laugenderfer, Elaine Musick, Mike Sutton

Abstract:

This document is the Interface Requirements Specification (IRS) for the Common Environment Modeling Component Set (CEMCS). It describes the interfaces of the components populating the ESAMS, ALARM, and RADGUNS (EAR) CEMCS. The purpose of the CEMCS is to provide a means of stadardizing the algotithms and software common to the EAR radio frequency (RF) models. It furnishes a framework for using the components by providing an overview of the design metrhodology used to create them, an explanation of the public inteerfaces, and engineering level details of their functionallity.

Report No.:
JTCG/AS-99-M-004
NGIC-1144-0077-99

Report Classification:
SECRET

Title: RADGUNS Air Defense Artillery Simulation - Version 2.2, Volume 4. Data Manual (U)

Issued: June 1999 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
Systems Directorate - Radar and Air Defense Division (IANG-SRA)
220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight G. FitzSimons, Ronald D. Williams, Susan R. Gordon, Steven E. Swier, Richard F. Alley

Abstract:

(U) The RADGUNS- Volume 4. Data Manual contains the classified portions of the RADGUNS documentation set. Section 1 provides the results of testing conducted at NGIC with the current version for comparison with the user's results. Configurations of the weapon systems that can be simulated by RADGUNS models are provided in Section 2 along with classified data on radars, guns, and firing doctrine. Similar data on the target data sets, previously provided with RADGUNS and available from SURVIAC, are included in Section 3. Users should examine this information closely to ensure that signature and vulnerability representations meet their expectations as well as to understand the limitations imposed by the data available. For classification purposes, the discussion on electronic attack (EA) systems previously included in this manual has been removed and is available through SURVIAC at the user's request. The discussion includes a review of the EA fundamentals upon which capabilities in RADGUNS are based. Specific characteristics and realistic parameters are also provided.

Report No.:
JTCG/AS-99-M-003
NGIC-1144-0076-99

Report Classification:
Unclassified

Title: RADGUNS Air Defense Artillery Simulation - Version 2.2, Volume 3. Analyst's Manual (U)

Issued: June 1999 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
Systems Directorate - Radar and Air Defense Division
(IANG-SRA)
220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight G. FitzSimons, Ronald D. Williams, Susan R. Gordon, Steven E. Swier, Richard F. Alley

Abstract:

RADGUNS is used to evaluate the effectiveness of air defense artillery (ADA) systems against penetrating aerial targets. It can also evaluate the effectiveness of different airborne target characteristics (radar cross section (RCS), maneuvers, use of electronic attack (EA), etc..) against a specific ADA systems. RADGUNS is a complete one-on-one simulation, including weapon system, operators, target model (RCS and vulnerable areas), flight paths, environment (clutter and multipath), and EA. Components of each weapon system are modeled at either the subsystem or circuit level, including the search and acquisition radar systems, a set of antiaircraft guns, a fire control computer (FCC)/servo system to aim the guns, and a crew to operate the system. The models are deterministic, or transfer function type, rather than stochastic (probabalistic). Pulse-by-pulse radar receiver models process the returns from the target (including multipath effects) and ground clutter. Probabilities of hit (Ph) and probabilities of kill (Pk) are calculated using distribution theory. RADGUNS can assess many aspects of a weapons system's performance: target detection, tracking performance (range-at-first-track, tracking errors, breaklocks, etc.), Ph and Pk, expected number of hits, and detailed studies of system performance under many different situations, such as jamming. Developed at NGIC for internal use and supplied to DoD agencies for on-site use, RADGUNS now has approximately seventy-five users (agencies and companies) in the Army, Air Force, Navy, Marine Corps, and DoD contractors. It has been selected by the JTCG/AS as its air defense gun model.

Report No.:
JTCG/AS-99-M-002
NGIC-1144-0075-99

Report Classification:
Unclassified

Title: RADGUNS Air Defense Artillery Simulation - Version 2.2, Volume 2. Programmer's Manual (U)

Issued: June 1999 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
Systems Directorate - Radar and Air Defense Division
(IANG-SRA)
220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight G. FitzSimons, Ronald D. Williams, Susan R. Gordon, Steven E. Swier, Richard F. Alley

Abstract:

The RADGUNS - Volume 2. Programmers Manual provides the RADGUNS hierarchal call tree and the descriptions, in alphabetical order, of the subroutines and functions in the RADGUNS program.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-M-001
NGIC-1144-0074-99

Report Classification:
Unclassified

Title: RADGUNS Air Defense Artillery Simulation - Version 2.2, Volume 1. User's Manual (U)

Issued: June 1999 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
Systems Directorate - Radar and Air Defense Division
(IANG-SRA)
220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight G. FitzSimons, Ronald D. Williams, Susan R. Gordon, Steven E. Swier,
Richard F. Alley

Abstract:

The Volume 1 - User's Manual of the RADGUNS documentation set provides information necessary to install, set up and execute the RADGUNS software.

An overview of the simulation, its organization and a description of the major changes in this version is provided in Section 1. It includes descriptions of the various coordinate frame conventions employed that users should understand to ensure proper set up and execution of the programs as well as correct interpretation of the output. Finally, it describes the procedures for reporting errors or problems with RADGUNS or to request additional capabilities.

Section 2 provides instructions on the installation of RADGUNS. Most users have hosted the software on UNIX-based workstaions although the PC version is becoming more widely used. Instructions are included for both platforms.

Section 3 provides instructions on executing RADGUNS on different platforms, including the proper initialization of input parameters for various simulations types (e.g., SINGL and MULTI). It also describes the post-processing of results used in the IVIEW and ModelU graphics programs. Lastly, this section contains a description of the kill probability types that can be generated and the default conditions used when no user inputs are specified for a given parameter.

Detailed descriptions and examples of certain parameters auch as radar cross section (RCS) and presented/vulnerable-area (PVA) data for targets and flight path options are provided in Section 4. Signature and vulnerability data are provided by SURVIAC for an array of targets for which such data has become available. The validity lof those data sets has not been established or documented. Users should examine them closely and compare them with other known sources before basing significant conclusions upon results derived from them. This section also describes the nine built-in flight path options and the BLUEMAX flight path option that is useful for complex profiles or target-specific maneuvers. The hill representation and scan-by-scan output option for examination of radar internal performance are also described.

Data file formats and representative output file contents/extracts are described in Section 5. Guidelines for analyzing results and producing data to be used in mission or higher level models are provided in Section 6. An abbreviated list of references is included in Appendix A. A more complete bibiography is available on request.

Classified results of testing conducted at NGIC with the current version are contained in Volume 4 - RADGUNS Data Manual (U). These testing results may be used for comparison with the user's results. Exact comparisons may not be possible due to rounding algorithms, but measures of performance such as numbers of expected hits and time in autotrack should compare closely with the user's results for the same inputs.

Report No.: **JTCG/AS-99-D-004**

Report Classification: **UNCLASSIFIED**

Title: Joint Technical Coordinating Group on Aircraft Survivability FY-2000 Program Book

Issued: October 1999 Final - FY-00

Sponsor:

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Author(s):
Individual SOW Project Engineers
Compiled by James A. Buckner, ASI Systems International

Abstract:

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) receives an R&D budget annually from the Office of the Under Secretary of Defense. The JTCG/AS is chartered by, and receives direction from, the Joint Aeronautical Commanders Group (JACG). The JTCG/AS has a Central Office which is the Program Office for the Joint Aircraft Survivability (JAS) R&D effort. This office is staffed with full time personnel. All other participants in the JTCG/AS are provided by the Services for purposes of coordinating and promoting improvements in combat aircraft survivability and to perform work on funded JTCG/AS program projects. Annually, the Services submit candidate joint R&D projects to the JTCG/AS for funding from the Program Budget. These submissions are reviewed by key personnel from within the JTCG/AS and are individually ranked. These rankings establish the JTCG/AS Order of Buy for the fiscal year. Budget guidance from OUSD for FY-2000 is $8.122 Million. This FY-00 JTCG/AS Program Book shows the organization of the JTCG/AS, and each Statement of Work for candidate FY-00 projects. The Program listing on pages 3 through 6 shows all candidate Projects which were approved for funding by the Principal Members Steering Group (PMSG).

Report No.: **JTCG/AS-99-D-003**

Report Classification: **UNCLASSIFIED**

Title: JTCG/AS Bibliography of Joint Aircraft Survivability Reports and Related Documents

Issued: July 1999 Final - 1975 through June1999

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Hwy
Arlington, VA 22202

Author(s):
James A. Buckner, compiler

Abstract:

This bibliography contains abstracts of published JTCG/AS reports and related documents. It is referenced by title and is organized by JTCG/AS Subgroup by year of publication. It is indexed by document number and by document title. This issue supersedes all previous issues. A copy may be obtained from the JTCG/AS Central Office.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-D-002

Report Classification:
Unclassified

Title: JTCG/AS Administrative Handbook

Issued: July 1999 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Hwy
Arlington, VA 22202

Author(s):
Central Office Staff, approved by Service Principal Members
Compiled by James A. Buckner, SRS Technologies

Abstract:

This document has been prepared in order to provide uniform administrative guidance to members of the Joint Technical Coordinating Group on Aircraft Survivability. The JTCG/AS is dedicated to providing a tri-service approach to enhancing the combat survivability of aircraft. This organization reports to the Joint Aeronautical Commanders Group (JACG). Funding is provided by the Office of the Secretary of Defense. Participants in JTCG/AS projects are required to utilize this manual as their guide in the management and reporting of Research and Development efforts funded through this joint program. This issue supersedes all previous issues. A copy may be obtained from the JTCG/AS Central Office.

Report No.:
JTCG/AS-00-V-005
D210-13501-1

Report Classification:

Title: Ballistic Tolerant Stiffeners

Issued: June 1999 Final

Sponsor:
Naval Air Warfare Center, Aircraft Division
Patuxent River, MD 20670-1906

Performing Organization:
The Boeing Company
Military Aircraft & Missiles Group
Philadelphia, PA 19142

Author(s):
Nikolas Caravasos

Abstract:

The objectives of the DoD Rotary Wing Technology Plan are to achieve significant improvements in fabrication cost, structural efficiency and survivability. The use of Z-pinning technology on composite materials offers a means of achieving thse objectives. This technolgy has demonstrated an ability to reinforce bond lines between composite details. both impact and ballistic tests have shown significant improvement in structural damage tolerance as a result of the use of Z-pin reinforcement. This report docuemnts the processes used to fabricate blade-stiffened plates where Z-pins have been used to attach the stiffeners to the plates. The stiffened plates are representative of the aft fuselage panels found on the V-22 Osprey aircraft. The report also includes a cost evaluation of the Z-pin technology. The fabricated panels wre forwarded to the Rapid Prototyping Division of the US Army Aviation Applied Technology Directorate for ballistic testing. These plates will then be tested for residual static and fatigue strength.

Report No.: JTCG/AS-00-D-002

Report Classification: Unclassified

Title: JTCG/AS Bibliography of Joint Aircraft Survivability Reports and Related Documents

Issued: July 2000 Final - 1975 through June 2000

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Hwy
Arlington, VA 22202

Author(s):
James A. Buckner, compiler

Abstract:

This bibliography contains abstracts of published JTCG/AS reports and related documents. It is referenced by title and is organized by JTCG/AS Subgroup by year of publication. It is indexed by document number and by document title. This issue supersedes all previous issues. A copy may be obtained from the JTCG/AS Central Office.

Report No.: WL-TR-91-3025 Vol I Part I

Report Classification: UNCLASSIFIED

Title: Self-Repairing Flight Control System Volume I: Flight Test Evaluation on an F-15 Aircraft

Issued: August 1991 Final

Sponsor:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Performing Organization:
McDonnell Aircraft Company

Author(s):
Urnes, James M.; Hoy, Stephen E.;Wells, Edward A.; Havern, William J.;
Norat, Kevin F.; Corvin, John H.

Abstract:

The self-repairing flight control system technologies consist of real-time reconfiguration and flight control maintenance diagnostics. A "proof of concept" flight test/demonstration was accomplished on the F-15 Highly Integrated Digital Engine control (HIDEC) airplane at NASA Ames-Dryden, Edwards AFB, CA. This report explains the technologies as developed by General Electric and documents their implementation for flight test. The testing is described and discrepancies between expected and exhibited system performance are analyzed. The effects of reconfiguration of flying/handling qualities are investigated.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-D-001

Report Classification:
UNCLASSIFIED

Title: Joint Technical Coordinating Group on Aircraft Survivability Organizational & Specialists Directory

Issued: April 1999 Final 1998 - 1999

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Author(s):
Compiled by James A. Buckner, SRS Technologies

Abstract:

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) annually publishes this directory of members of the JTCG/AS organization and of government and industry specialists in the aircraft survivability design discipline. This directory is intended to be a desk reference for the specialists themselves in the coordination of aircraft survivability programs and information . No effort is made to validate or verify the claimed specialties provided by the individuals listed. The data base for this directory is maintained at the JTCG/AS Central Office. Changes are made when received during the year and a copy of the data base record is distributed to each individual at year end for update purposes.

Report No.:
JTCG/AS-99-M-010
SURVIAC TR-99-005

Report Classification:
Unclassified

Title: Collection and Incorporation of Propulsion Data into the Component Vulnerability Analysis Archive (U)

Issued: February 1999 Final January 1998 - February 1999

Sponsor:
NAWCWPNS, CODE 418100D
1 Administration Circle
china Lake, CA 93555-6100

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 Colonel Glenn Highway, Suite 131
Dayton, Ohio 45431

Author(s):
Bennett, Gerald (SURVIAC)

Abstract:

One of the most critical and debated inputs to the nonnuclear vulnerability analysis process is an estimate of the probability of kill given a hit (Pk/h). The Pk/h value is unique to each target design since it is a function of both the component response and the response of the target given that component response. For example, loss of thrust of a turbofan engine can result in the loss of a single engine aircraft, but may not result in the loss of a multi-engine aircraft.

This Pk/h function can thus be defined as the product of two probabilities, the probability of component damage given a hit (Pd/h or Pcd/h) and the probability of achieving the defined target kill given that component damage (Pk/d). The Pk/d function is unique to the component installation in the target, while the Pd/h (or Pcd/h) is a function of the component design. Since the Pd/h (or Pcd/h) is dependent on the component construction, estimates can be made for specific component designs and used in analyses of their installation in various targets. In order to archive these component vulnerability data and the associated methodologies the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) and the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME) initiated the Joint Component Vulnerability Program (JCVP). As part of the JCVP a Component Vulnerabiltiy Analysis Archive (CVAA) computerized database program was developed. This effort was to begin to populate the CVAA in the area of propulsion system data and analyses for aerial and ground targets.

This report documents the procedures developed for review and selection of data and the associated "lessons learned" during this initial population effort. It also contains a bibliography of reports used in the Services for inputs to vulnerability analyses.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-M-009

Report Classification:
Unclassified

Title: Software User's Manual for the Advanced Low Altitude Radar Model (ALARM), Version 4.1

Issued: 1 November 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
Science Applications International Corporation
4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning, John Langender, Mike Sutton, and Elaine Musick

Abstract:

The Software User's Manual (SUM) provides the basic procedures for executing the Advanced Low Altitude Radar Model (ALARM) computer software configuration item (CSCI). Also included are instructions for executing ALARM support programs: BINPRO; DIMENS; GRAPHITE; PDMERG; and PAREPGP, all of which are off-line computer software components (CSC). The SUM contains the basic informaiton needed to execute ALARM and is split into several appendixes that informaiton and samples for setting up and running ALARM.

Report No.:
JTCG/AS-99-M-008

Report Classification:
Unclassified

Title: Software Programmer's Manual for the Advanced Low Altitude Radar Model (ALARM), Version 4.0

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
Science Applications International Corporation
4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning, John Langender, Mike Sutton, and Elaine Musick

Abstract:

The Software Programmer's Manual (SPM) describes ALARM from the computer science perspective and is intended to be a guuide to the structure and methodology of the model. First, this document identifies the software programming environment necessary for ALARM. This is followed by the programming information associated with the computer science implemention of ALARM. This information is organized in the same manner as the model's source code.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-99-M-007

Report Classification:
Unclassified

Title: ALARM Operational Concepts Document (Analyst Manual), Version 4.0

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
Science Applications International Corporation
4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning, John Langender, Mike Sutton, and Elaine Musick

Abstract:

This document describes the engineering implementation of ALARM, addressing pulsed, moving target indicaiton (MTI), and pulse doppler radars. The engineering implementation of both external and internal signals is discussed. External signals are those associated with the target body, target rotor blade, jammer, and clutter. Internal signals are those associated with the system noise and signal-to-interference ratio (S/I). The implementaion of Doppler filters, MTI systmes, and the clutter response of these systems is discussed. The implementation of support functions such as atmospheric attenuation, MTI system gating, pattern propagation factor, pulse blanking and eclipsing, radar antenna gain, detection theory, target radar cross section (RCS) and the clutter reflectivity for land and sea. Lastly the geometry and terrain simulation support functions are discussed. Where appropriate, the ODC/AM relates the theory to the implementation of the methodology in ALARM.

Report No.:
JTCG/AS-98-V-004

Report Classification:
Unclassified

Title: More-Electric Aircraft Vulnerability Analysis (MELVAN) Phase I Final Report

Issued: 18 November1998 FINAL 12/01/97 - 08/31/98

Sponsor:
POC: Bruce Clough, AFRL/VACC (937) 255-2831
Air Vehicles Directorate
Air Force Research Laboratory
Wright Patterson Air Force Base, OH 45344-7521

Performing Organization:
Northrup Grumman Corporation
Military Aircraft Systems Division
One Northrup Avenue
Hawthorne, CA 90250-3277

Author(s):
Mahood, et al.

Abstract:

This report covers the development of a More-Electric aircraft model for vulnerability studies. The report takes the development from a concept through the completion of a FASTGEN4 CAD model to be used later in the MELVAN program.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-V-002

Report Classification:
Unclassified

Title: Machine Vision Fire Detector for Aircraft Fire Detection

Issued: 1 April 1997 Final Report 5/24/93 - 4/1/97

Sponsor:
AFRL/VAVS
1901 Tenth Street, Building 63
Wright-Patterson AFB, OH 45433-7605

Performing Organization:
Donmar Ltd.
901 Dover Drive, Suite 120
Newport Beach, CA 92660

Author(s):
A. Donald Goedeke

Abstract:

This project was a best level of effort to develop two types of fire/explosion detectors based upon machine vision technology which included the integration of video imagery, computer image processing, fiber optics and pattern recognition. The specific objectives were two-fold: (1) to develop a single detector capable of simultaneously monitoring via fiber optics several fire threat areas of an aircraft's engine compartment/nacelle, and detecting fuel fires in 1 sec or less, and (2) to develop an engineering prototype detector capable of detecting incendiary explosions in dry bays in 5 msec or less and discriminating between explosive and ensuing fuel fire events. The first objective was met, including the successful development and tests of a four fiber optic cable system with each cable containing 13,000 coherent strands of quartz (1 mm diameter). The image quality was tested to have no degradation out to 17 ft length.

The drybay detector objective was partially met. It had a problem in capturing frames for past data analysis (which was not a detector function but a data analysis tool). Although it was successful in several tests to respond in 5 msec, it also failed in a few tests to discriminate explosion and fire. The threshold logic setting appeared to be the cause. The drybay detector was not completely debugged due to scheduling problems and availability of the test facility at WPAFB. further development and test is warranted.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-V-001
L9KVW-FP-98001

Report Classification:
Unclassified

Title: Rotorcraft Fluidic Flight Control System (RFFCS)

Issued: 25 Feb 1998 FINAL Sep 96 TO Feb 98

Sponsor:
Aviation Applied Technology Directorate (AATD)
U.S. Army Aviation and Missile Command
Attn: AMSAM-AR-T-C
Fort Eustis, VA 23604-5577

Performing Organization:
McDonnell Douglas Helicopter Systems (MDHS)
5000 E. McDowell Road
Meza, AZ 85215

Author(s):
John B. Winkler, Russell Enns

Abstract:

MDHS installed and tested a Rotorcraft Fluidic Flight Control System (RFFCS) in an AH-64A Apache aircraft in 1996-1997. This program was an outgrowth of the Integrated Pump Actuator Program (IPAP) performed in 1991-1993 by MDHS and its primary sub-contractor, Allied Signal Fluid Systems. The purpose of the IPAP program was to enhance the survivability of future attack helicopter Fly-by-Wire systems. Two aspects of aircraft vulnerability that were addressed in the IPAP program were: 1) an integrated pump actuator power system for tail rotor controls to eliminate the long, vulnerable hydraulic supply lines to the tail boom, and 2) to provide a fluidic backup control system for FBW that would provide continued control after loss of all electrical power.

During 1996-1997, MDHS (now Boeing) upgraded the IPAP fluidic equipment and developed a new aircraft installation using a modified "A" model production Apache aircraft PV-467. The RFFCS flight test demonstrated that: 1) the integrated pump actuator module did not overheat in flight and supplied adequate hydraulic power to the actuator, 2) the RFFCS system can be successfully engaged in flight and is capable of responding to the pilot's yaw directional control inputs, 3) the RFFCS system exhibited a problem that caused +/- 10 degree yaw oscillations with a period of approximately 2 seconds. The yaw stability augmentation system appeared to be limit-cycling at approximately 0.5 Hertz due to high gain from the angular rate sensor through the washout circuit. Budget constraints did not allow the problem to be resolved, and testing was stopped after only one RFFCS test flight.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-M-009
N/A

Report Classification:
Unclassified

Title: Accreditation Support Package for COVART, Volume I (ASP I)

Issued: 30 Sept 1998 Final Repoort 1998

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability
1213 Jefferson Davis Highway, Suite 1103
Arlington, Virginia 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center Weapons Division
Code 418100D, China Lake, California 93555-6001

Author(s):
R. Bennett, R. Levy, P.R. Muessig, B. O'Neal, T. Rindt

Abstract:

This docuemnt is designed to provide users with a characterization of the current state of COVART with respect to criteria related to its general acceptibility for use. The acronym COVART refers to the Computations of Vulnerable Area and Repair Time Program maintained by the JTCG/AS. Information collected for Volume I of the accreditation support package (ASP) is presented in sections that address the following: 1) Configuration Management (CM) policies, procedures, guidelines, and support functions along with a description of the current version and its development history; 2) a summary of assumptions and limitations inherent in the model design or implementation and a listing of known errors that might impact intended usage; 3) a review of the verification and validation (V&V) efforts applied to the model and a history of its use in study or analysis projects; 4) an assessment of documentation quality with emphasis on requirements or V&V that might be required, and 5) an assessment of software quality with respect to accepted standards and practices that could mitigate risks associated with intended or required modification or development efforts. The degree to which the information provided meets requirements for intended use of the model serves to facilitate further consideraiton or rejection of it as a potential candidate for accreditation.

Report No.:
JTCG/AS-98-M-008

Report Classification:
Unclassified

Title: A Report on the Expert Review of ALARM 3.1, AIRADE 7.2, and the Flight Simulator Used in the F/A-18 E/F Survivability Analysis

Issued: 6/15/98 Final

Sponsor:
N/A

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6100

Author(s):
Lail, J. B.; McCormick, T.; Wrobleski, J.

Abstract:

An Expert Review Panel was convened from 24 - 25 February 1998 to perform a preliminary assessment of the Advanced Low Altitude Radar Model (ALARM 3.1), the Airborne Radar Detection and Evaluation model (AIRADE 7.2), and the Boeing F/A-18 Manned Flight Simulator used in the comparative F/A-18E/F survivability analysis. The purpose of this assessment was to determine if the models were suitable for use in this particular study; if deficiencies existed, to determine if they could be overcome, if the model should be improved, or if another more applicable model existed; and to determine if there was a need for additional verification and validation (V&V) to improve model credibility. This document describes the review process and the application description, provides an overview of the modeling requirements for this application, gives an overview of the selected models, and provides an assessment of the models' capabilities against those requirements. A summary of the critical comments and conclusions of the panel as well as their recommendations for future actions is also provided.

Report No.:
JTCG/AS-98-M-007
None

Report Classification:
Unclassified

Title: Software User's Manual for the Advanced Low Altitude Radar Model (ALARM), Version 4.0

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
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4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning, John Langender, Mike Sutton, and Elaine Musick

Abstract:

The Software User's Manual (SUM) provides the basic procedures for executing the Advanced Low Altitude Radar Model (ALARM) computer software configuration item (CSCI). Also included are instructions for executing ALARM support programs: BINPRO; DIMENS; GRAPHIT; PDMERG; and PREPGP, all of which are off-line computer software components (CSC). The SUM contains the basic information needed to execute ALARM land is split into several appendixes that information and samples for setting up and running ALARM.

Report No.:
JTCG/AS-98-M-006
None

Report Classification:
Unclassified

Title: Software Programmer's Manual for the Advanced Low Altitude Radar Model (ALARM), Version 4.0

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
Science Applications International Corporation
4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning, John Langender, Mike Sutton, and Elaine Musick

Abstract:

The Software Programmer's Manual (SPM) describes ALARM from the computer science perspective and is intended to be a guide to the structure and methodology of the model. First, this document identifies the software programming environment necessary for ALARM. This is followed by the programming information associated with the computer science implementation of ALARM. This information is organized in the same manner as the model's source code.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-M-005
None

Report Classification:
Unclassified

Title: ALARM Operational Concepts Document (Analyst Manual), Version 4.0

Issued: 1 June 1999 Final

Sponsor:
Information Directorate
AFRL AFMC
WPAFB, OH 45433-7334
POC: Russ Nourse AFRL/IFSD (937) 255-2164

Performing Organization:
Science Applications International Corporation
4031 Colonel Glenn Highway
Beavercreek, OH 45431-1673

Author(s):
Kenneth Allen, David Bergman, Bruce Esken, Paul Hannen, Lawrence Janning,
John Langender, Mike Sutton, and Elaine Musick

Abstract:

This document describes the engineering implementation of ALARM, addressing pulsed, moving target indication (MTI), and pulse Doppler radars. The engineering implementation of both external and internal signals is discussed. External signals are those associated with the target body, target rotor blade, jammer, and clutter. Internal signals are those assoicated with the system noise and signal-to-interference ratio (S/I). The implementation of Doppler filters, MTI systems, and the clutter response of these systems is discussed. The implementation of support functions such as atmospheric attenuation; MTI system gating, pattern propagation factor, pulse blanking and eclipsing, radar antenna gain, detection theory, target radar cross section (RCS) and the clutter reflectivity for land and sea. Lastly, the geometry and terrain simulation support functions are discussed. Where appropriate, the OCD/AM relates the theory to the implementation of the methodololgy in ALARM.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-M-003
SURVIAC TR-97-034

Report Classification:
Unlassified

Title: Prodcedures for Review and Acceptance of Component Vulnerability (Pd/h Data or Analysis Methodologies)

Issued: Sept 1997 Final Mar 97 - Sep 97

Sponsor:
Aeronautical Systems Center
ASC/XREC
Building 16, 2275 D Street
Wright-Patterson AFB, Ohio 45433-7227

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 Colonel Glenn Highway, Suite 131
Dayton, Ohio 45431

Author(s):
Edited by Gerald Bennett

Abstract:

One of the most critical and debated inputs to the non nuclear vulnerability analysis process is an estimate of the probability of kill given a hit (Pk/h). The Pk/h value is unique to each target design since it is a function of both the component response and the response of the target given that component response. For example, loss of thrust of a turbofan engine can result in the loss of a single engine aircraft, but may not result in the loss of a multiengine aircraft.

The Pk/h function can thus be defined as the product of two probabilities, the probability of component damage given a hit (Pd/h) and the probability of achieving the defined target kill given that component damage (Pk/d). The Pk/d function is unique to the component installation in the target, while the Pd/h is a function of the component design.

Since the Pd/h is dependent on component construction, estimates can be made for specific component designs and used in analyses of their installation in various targets. However, the existing component vulnerability data is typically scattered, of varying quality, perishable, and often not well documented or traceable. To address the component vulnerability data and methodology problem, the JTCG/AS and JTCG/ME formed the Joint Component Vulnerability Project (JCVP). The purpose of the JCVP is to define, develop, and populate a computerized archive of component vulnerability data and associated analysis procedures. The data and procedures are to encompass aerial, ground, ship and building targets. This document summarizes the procedures for review and acceptance of data and methodologies for inclusion in the computerized archive.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-M-002

Report Classification:
Unclassified

Title: **A Report on the Expert Review of TRAP 3.1A and JSEM 2.2 Used in the F/A-18 E/F Air-to-Air Survivability Analysis**

Issued: 4/7/98 Final

Sponsor:
N/A

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6100

Author(s):
Lail, J. B.; McCormick, T.; Richardson, C.; Wrobleski, J.

Abstract:

An Expert Review Panel was convened from 30 June to 2 July 1997 to perform a preliminary assessment of Trajectory Analysis Program Version 3.1A (TRAP 3.1A) and Joint Service Endgame Model Version 2.2 (JSEM 2.2) for use in comparing the survivability of the F/A-18E/F to the F/A-18C/D during air-to-air engagements. The purpose of this assessment was to determine if the models were suitable for use in this particular study; if deficiencies existed, to determine if they could be overcome, if the model should be improved, or if another more applicable model existed; and to determine if there was a need for additional verification and validation (V&V) to improve model credibility. This document describes the review process and the application description, provides an overview of the modeling requirements for this application, gives an overview of the selected models, and provides an assessment of the models' capabilities against those requirements. A summary of the critical comments and conclusions of the panel as well as their recommendations for future actions is also provided.

Report No.:
JTCG/AS-98-M-001

Report Classification:
Unclassified

Title: **A Report on the Expert Review of ESAMS 2.7/2.8 and Supporting Models Used in the F/A-18 E/F Surface-to-Air Survivability Analysis**

Issued: 4/6/98 Final

Sponsor:
N/A

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6100

Author(s):
Lail, J. B.; McCormick, T.; Richardson, C.; Wrobleski, J.

Abstract:

An Expert Review Panel was convened from 16 - 18 September 1997 to perform a preliminary assessment of the Enhanced Surface-to-Air Missile Simulation Version 2.7/2.8 (ESAMS 2.7/2.8) and related models for use in comparing the survivability of the F/A-18E/F to the F/A-18C/D during surface-to-air engagements. The purpose of this assessment was to determine if the models were suitable for use in this particular study; if deficiencies existed, to determine if they could be overcome, if the model should be improved, or if another more applicable model existed; and to determine if there was a need for additional verification and validation (V&V) to improve model credibility. This document describes the review process and the application description, provides an overview of the modeling requirements for this application, gives an overview of the selected models, and provides an assessment of the models' capabilities against those requirements. A summary of the critical comments and conclusions of the panel as well as their recommendations for future actions is also provided.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-D-004

Report Classification:
Unclassified

Title: Integrated Survivability Assessment

Issued: 10/5/98 FINAL

Sponsor:
JTCG/AS

Performing Organization:
Naval Air Warfare Center, Weapons Division
Code 418100D
1 Administration Circle
China Lake, CA 93555-6100

Author(s):
Atkinson, Dale B.; Gormley, RADM Robert Ret.

Abstract:

This report documents the results of tasking acomplished for the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) under JTCG/AS Project A-7-02, "Integrated SurvivabilityAssessment". The Objective of this task was to develop a draft integrated survivability assessment plan, describing the requirements for developing an integrated survivability assessment process in the near future. Fielding combat survivable aircraft involves the establishment of operational requirements for survivability and the melding of those requirements with available and near-term technologies. As a consequence, system development is of necessity an iterative process between user demands for enhanced survivability on the one hand, and on the other the cost and feasibility of meeting these requirmeents through tactical and/or technical means. It follows that a credible trade-off analysis and overall survivability assessment capability is fundamental to the process of making combat survivable aircraft available to ooperaitonal uinits. Therefore, an integrated survivability assessment capability should today, and in future years increasingly serve as the foundation for aircraft survivability programs of the military services.

Report No.:
JTCG/AS-97-M-014

Report Classification:
Unclassified

Title: A Report on the Expert Review of COVART 4.1 and Supporting Models Used in the F/A-18 E/F Vulnerability Analysis

Issued: 7/31/97 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6100

Author(s):
Lail, J. B.; Richardson, C.; Wrobleski, J.

Abstract:

An Expert Review Panel was convened from 6 -7 May 1997 to perform a preliminary assessment of the COVART 4.1 and supporting models for use in comparing the vulnerability of the F/A-18E/F to the F/A-18C/D. The purpose of this assessment was to determine if the models were suitable for use in this particular study; if deficiencies existed, to determine if they could be overcome, if the model should be improved, or if another more applicable model existed; and to determine if there was a need for additional verification and validation (V&V) to improve model credibility. This document describes the review process and the application description, provides an overview of the modeling requirements for this application, gives an overview of the selected models, and provides an assessment of the models' capabilities against those requirements. A summary of the critical comments and conclusions of the panel as well as their recommendations for future actions is also provided.

Report No.: NAWCWPNS TP 8382, Part 2

Report Classification: SECRET-NOFORM-WNINTEL

Title: F/A-18E/F Live Fire Test and Evaluation Plan for Live Fire Test Article SV52(U) Part 2. Threats to the F/A-18E/F Aircraft (U)

Issued: July 1998 Final Report 1992-1997

Sponsor:
PMA-265(AIR-4.1.1),
Office of the Secretary of Defense
Deputy Director of Operaitonal Test and Evaluation,
Live Fire Test (DOT&E/LFT)

Performing Organization:
Naval Air Warfare Center Weapons Division
Code 418300D
China Lake, California 93555-6100

Author(s):
J. Hardy Tyson and Susan L. Hennigan

Abstract:

(U) This document describes the threat systems likely to be encountered by the F/A-18E/F aircraft during combat operations. Part I of this document (subtitled Overview) comprises the formal Live Fire Test (LFT) plan for the SV52 full-scale test article. Pretest predictions for the planned LFTs are detailed in Part 3 (subtitled F/A-18E/F Live Fire Test Predictions).
(U) All planned ballistic tests will be performed at the Naval Air Warfare Center Weapons Division (NAWCWPNS), China lake, California at the Weapons Survivability Laboratory (WSL). These tests will be conducted under the sponsorship of PMA 265 (AIR-4.1.1) and are being performed to test the survivability and vulnerability of the operational F/A-18E/F aircraft to threat systems likely to be encountered in combat. Results of the SV52 LFTs will be integrated into a complete vulnerability assessment of the F/A-18E/F aircraft using computer models and simulaitons; the benefits of using such LFT data are improved accuracy and increased confidence in model output.

Report No.: NAWCWPNS TP 8382, Part 3

Report Classification: SECRET

Title: F/A-18E/F Live Fire Test and Evaluation Plan for Live Fire Test Article SV52(U) Part 3. Threats to the F/A-18E/F Aircraft (U)

Issued: July 1998 Final Report 1992-1997

Sponsor:
PMA-265(AIR-4.1.1),
Office of the Secretary of Defense
Deputy Director of Operaitonal Test and Evaluation,
Live Fire Test (DOT&E/LFT)

Performing Organization:
Naval Air Warfare Center Weapons Division
Code 418300D
China Lake, California 93555-6100

Author(s):
J. Hardy Tyson and Susan L. Hennigan and Charles E. Frankenburger

Abstract:

(U) This document describes the threat systems likely to be encountered by the F/A-18E/F aircraft during combat operations. Part I of this document (subtitled Overview) comprises the formal Live Fire Test (LFT) plan for the SV52 full-scale test article. Pretest predictions for the planned LFTs are detailed in Part 3 (subtitled F/A-18E/F Live Fire Test Predictions).
(U) All planned ballistic tests will be performed at the Naval Air Warfare Center Weapons Division (NAWCWPNS), China lake, California at the Weapons Survivability Laboratory (WSL). These tests will be conducted under the sponsorship of PMA 265 (AIR-4.1.1) and are being performed to test the survivability and vulnerability of the operational F/A-18E/F aircraft to threat systems likely to be encountered in combat. Results of the SV52 LFTs will be integrated into a complete vulnerability assessment of the F/A-18E/F aircraft using computer models and simulaitons; the benefits of using such LFT data are improved accuracy and increased confidence in model output.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-V-003
SURVIAC TR-98-022

Report Classification:
Unclassified

Title: Evaluation of Aircraft Fuel Tank Design and Ullage Vulnerability Implications

Issued: July 1998 Final July 1997 - July 1998

Sponsor:
Air Force Research Laboratory
AFRL/VAVS
Building 16, 2275 D Street
Wright-Patterson Air Force Base, Ohio 45433-7227

Performing Organization:
Booz Allen & Hamilton, Inc.
4141 colonel Glenn Highway, suite 131
Dayton, OH 45431

Author(s):
Bennett, Gerald; Frederick, Scott

Abstract:

Historically, damage to the fuel system has been one of the largest contributors to aircraft combat loss. Fire and explosion, usually related to damage to the fuel system, were major causes of aircraft loss in Viet Nam, Korea, and World War II. Projectiles penetrating the fuel tank can cause explosion in the ullage, fuel tank rupture, fire or loss of fuel. The fuel tank location with respect to unprotected dry bays and other fire sources is important. An important possible fuel tank related kill mechanism involves hydrodynamic ram with the energy from the projectile propagating through the fuel and producing large loads on the fuel tank walls with possible rupture.

The design of a survivable fuel system must consider all the possible failure mechanisms. If the fuel tank is full, the probability of threats producing large hydrodynamic ram pressures on the fuel tank walls increases. As the fuel level in the tank decreases, the fuel becomes decoupled from the structure, resulting in decreasing hydrodynamic ramp overpressures. On the other hand, as the percentage of tank ullage increases, the probability of in-tank fire/explosion increases. This report summarizes the results of an effort (1) to identify typical fuel tank ullage percentages for selected aircraft types, tank positions, and missions and (2) through a selective examination of combat and ballistic test data, to identify the implications of ullage relative to hydrodynamic ram, fire, and explosion probabilities.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-98-D-003

Report Classification:
UNCLASSIFIED

Title: Joint Technical Coordinating Group on Aircraft Survivability FY-1999 Program Book

Issued: October 1997 Final - FY-98

Sponsor:

Performing Organization:
JTCG/AS Central Office
Crystal Square #2, Suite 1003
1725 Jefferson Davis Highway
Arlington, VA 22202-4102

Author(s):
Individual SOW Project Engineers
Compiled by James A. Buckner, ASI Systems International

Abstract:

The Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) receives an R&D budget annually from the Test and Evaluation Office of the Under Secretary of Defense. The JTCG/AS is chartered by, and receives direction from, the Joint Aeronautical Commanders Group (JACG). The JTCG/AS has a Central Office which is the Program Office for the Joint aircraft survivability R&D effort. This office is staffed with full time personnel. All other participants in the JTCG/AS are provided by the Services for purposes of coordinating and promoting improvements in combat aircraft survivability and to perform work on funded JTCG/AS program projects. Annually, the Services submit candidate joint R&D projects to the JTCG/AS for funding from the Program Budget. These submissions are reviewed by key personnel from within the JTCG/AS and are individually ranked. These rankings establish the JTCG/AS Order of Buy for the fiscal year. Budget guidance from OUSD for FY-1998 is $7.8 Million. This FY-98 JTCG/AS Program Book shows the organization of the JTCG/AS, and each Statement of Work for candidate FY-98 projects. The Program listing on pages 3 through 6 shows all candidate Projects and indicates those approved and not approved for funding by the Principal Members Steering Group (PMSG).

Report No.:
JTCG/AS-97-V-010
WL-TR-97-3071

Report Classification:
UNCLASSIFIED

Title: Ballistic Survivability of Thermoplastic Structures

Issued: 30 June 1997 Final June 1992 - June 1997

Sponsor:
Wright Laboratory, Flight Dynamics Directorate
POC: Forrest Sandow, WL/FIBA
WL/FIBA Building 45
WPAFB, OH 45433-7542

Performing Organization:
McDonnell Douglas Aerospace
St. Louis, MO 63166-0516

Author(s):
Robert C. Hipp, Charles R. Saff

Abstract:

Improving the survivability of fighter aircraft structures against ballistic threats offer significant design and analysis challenges. The presence of fluid in the cavity contributes to hydrodynamic ram effects where the fluid behaves as an effective energy transferring media the impulse transfers kinetic/explosive energies of the projectile to the walls of the fuel tank. The resulting dynamic interaction of the fluid mechanisms with fundamental structural responses formulate a complex problem for which optimum solutions require an understanding of material characteristics, fluid mass motion, and failure mechanisms. This report resents results of high strain rate and static polymer matrix composites element and sub component testing conducted to characterize the effects of selected survivability design studies. High strain rates and load rate conditions such as those found in ballistic events were imposed as part of these experimental investigations.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-V-009
SwRI Report 06-7365/002

Report Classification:
Unclassified

Title: Numerical Simulation of a 23-mm HEI Impact and Detonation Experiment

Issued: September 1997 Final Report for 9/95 - 4/97

Sponsor:
Air Vehicles Directorate - Wright Laboratory - AFMC
AFRL/VAVS
Wright-Patterson Air Force Base, OH 45433-7562
POC: Greg Czarnecki, AFRL/VAVS, 937 255-6052

Performing Organization:
Southwest Research Institute
Materials and Structures Division
6220 Culebra Road, P.O. Drawer 28510
San Antonio, TX 78228-0510

Author(s):
Charles E. Anderson, Jr., Gerald I. Kerley, James D. Walker, T. R. Sharron, Christopher J. Freitas

Abstract:
An Eulerian wavecode was used to simulate the impact, penetration, and detonation of a 23-mm high explosive projectile into a water-filled tank. The pressure-time response is compared to results from an experiment conducted by Lundstrom and Anderson (*Symp. on Shock and Wave Propagation, Fluid-Structure Interaction, and Structural Responses,* 1989). A critical analysis of the equation of state for water was conducted wherein five different published equations of state were compared to shock physics experimental data. A revised equation of state for water, using a Mie-Gruneisen form, was developed and then used for the study. Parametric studies were conducted to investigate the influence of mesh resolution, equation of state, sensitivity to high explosive burn, and projectile casing strength. an analysis of similar experimental data, but with a different mass for the high explosive, permitted a plot of peak pressure versus scaled distance. It was found that the simulations results are in excellent agreement with these data. Scaled impulses versus scaled distance from the simulation were also compared to a limited set of experimental data; the numerical results lay within the data scatter.

Report No.:
JTCG/AS-97-V-008
NAWCWPNS-TM-8133

Report Classification:
CONFIDENTIAL

Title: F404 Engine Afterburner Duct Battle Damage Repair

Issued: June 1997 FINAL Jan-June 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center Weapons Division
China Lake, CA 93555-6100

Author(s):
Hau Nguyen

Abstract:
(U) Engine Battle Damage Repair (EBDR) was conducted on an F404-GE-400 engine afterburner duct. The engine duct was subjected to impacts of 23mm API, 30mm API, 23mm HEI, 30mm HEI, and a cut-out hole about 8 inches in diameter. The engine operations were conducted before and after the damage was repaired.

Report No.:
JTCG/AS-97-V-005
ARL-TR-1307

Report Classification:
UNCLASSIFIED

Title: Concealable Body Armor Inserts for Military and Civilian Personnel

Issued: March 1997 Final, May 95 - Feb 96

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S. Army Research Laboratory
ATTN: AMSRL-MA-F
Aberdeen Proving Ground, MD 21005-5069

Author(s):
James F. Mackiewicz

Abstract:

Several lightweight and stealthy armor systems have been designed for the defeat of Soviet 7.62-mm M1943 ball projectiles. Specifically, two armor systems have been developed provide enhanced protection to units that require inconspicuous or non detectable body armor. Special military and civilian units require higher protection levels than currently provided by military/commercial soft armor vests. In order for these units to perform their mission, it is essential that the armor vest be as undetectable as possible. The U.S. Army Research Laboratory (ARL) was tasked by the Defense Advanced Projects Research Projects Agency (DARPA) to provide armor materials/systems that will provide higher protection levels than conventional soft level IIIA materials (level IIIA as defined in the National Institute of Justice Standard 0101.03, Ballistic Resistance of Police Body Armor). The objective put forward to ARL was to design, in a 3 month period, at least one lightweight, inconspicuous armor system that will at a minimum, defeat the Soviet 7.62-mm M1943 ball projectile at 300-m range and 0 degree obliquity.

Report No.:
JTCG/AS-97-V-005

Report Classification:
Unclassified

Title: Aircrew Integrated Recovery Survival Armor Vest & Equipment (AIRSAVE) Final Report

Issued: Final Report 1996-1997

Sponsor:
Naval Air Systems Command (PMA 202)
IPT Building
Patuxent River, MD 20653

Performing Organization:
Naval Air Warfare Center
Aircraft Division
Patuxent River, MD 20653

Author(s):
John Meyers, R. Brian Harvey, P.E.

Abstract:

The Aircrew Integrated Recovery Survival Armor Vest and Equipment, or AIRSAVE, is a newly developed system that consists of three components: a survival vest, soft body armor and hard body armor. Floatation is an optional fourth component. The AIRSAVE survival vest features a removable hoisting harness and modular/removable pockets. It is compatible with all chemical-biological protective systems, various oxygen systems, all floatation systems, body armor systems and numerous survival equipment. The AIRSAVE soft body armor provides protection from fragmentation and small arms fire; whereas, the AIRSAVE hard body armor system protects the user from up to .30 caliber armor piercing rounds. The hard armor features a quick-release mechanism for emergency egress situations. The AIRSAVE system has been tested, evaluated and adopted by the Army, Navy and Marines.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-V-004
NAWCWPNS TM 8131

Report Classification:
UNCLASSIFIED

Title: Results of JTCG/AS Project V-6-10, Advanced Gas Generator Technology

Issued: November 1997 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NAWCWPNS (Code 418300D)
1 Administration Circle
China Lake, CA 93555-6100

Author(s):
Joseph A. Manchor

Abstract:

Inert gas generators have shown great potential as an alternative to Halon 1301 in aircraft dry bay fire suppression applications. However, the pyrotechnic propellant utilized by inert gas generators was originally developed for automobile air bag inflation applications. It is possible to develop a pyrotechnic propellant specifically for fire suppression applications. Such a propellant may enable the design of much smaller, lighter, and more effective fire suppression systems than any of the current Halon alternatives. JTCG/AS Project V-6-10, "Advanced Gas Generator Technology" was initiated to develop and demonstrate this type of advanced propellant, with the ultimate goal of technology transfer to industry. This report outlines the results of this project.

Report No.:
JTCG/AS-97-V-003
06-7365-001

Report Classification:
Unclassified

Title: Hydrodynamic Ram: A Review of Experimental Data for Use in Validation of Numerical Simulations

Issued: April 1997 Final Report for 9/95 - 4/97

Sponsor:
Air Vehicles Directorate - Wright Laboratory - AFMC
AFRL/VAVS
Wright-Patterson Air Force Base, OH 45433-7562
POC: Greg Czarnecki, AFRL/VAVS, 937 255-6052

Performing Organization:
Southwest Research Institute
Materials and Structures Division
6220 Culebra Road, P.O. Drawer 28510
San Antonio, TX 78228-0510

Author(s):
Christopher J. Freitas, Charles E. Anderson, Jr., and Drew L. Goodlin

Abstract:

Hydrodynamic Ram (HR) refers to the physical effect (or force) transmitted to the walls of a liquid filled container by the action of a projectile penetrating that container and transferring its kinetic energy to the liquid. The resulting fluid pressures serve as the coupling mechanism to transfer this kinetic energy from the liquid to the walls of the container, causing abnormally excessive, structural damage. The primary purpose of this report is to support the development of new models for HR simulation. A critical step in this process is the validation of computational tools. This validation step is performed through direct comparison with benchmark experimental data. This report presents a series of seven experiments that can serve in this function. These seven experiments describe a hierarchy of phenomena, progressing from more simple geometries and projectiles to complete wing segments and detonating high explosive rounds. In this report, the details of each experiment are presented along with key experimental results. By performing this compilation of experimental data, a single source of information now exists for use in evaluating and validating the accuracy of computational models for HR phenomena.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-S-002
DHPC Report 97-071

Report Classification:
Unclassified

Title: Pointing and Tracking System Design Methodology for Directional Infrared Countermeasures Systems

Issued: July 14, 1997 Final March 26, 1997 - May 30, 1997

Sponsor:
U.S. Army CECOM\
NVES Directorate
AMSEL-RD-NV-SR-S

Performing Organization:
David H. Pollock Consultants, Inc.
99 Kinderkamack Road, Suite 308
Westwood, NJ 07875
(201) 722-0615

Author(s):
Peter J. Kennedy and Jersey Nowakowski

Abstract:

This design methodology addresses the requirements for pointing the laser transmitter beam of infrared countermeasure systems (IRCM) at attacking missiles and tracking these missiles throughout their flyout trajectory. The gimbal stabilization bias and jitter induced error limits are established by the unique IRCM requirement to maintain a given minimum jamming power to platform signature power ratio (JSR) at all times on the missile seeker entrance aperture.
The impact of atmospheric turbulence and protected platform engine exhaust plumes on the laser beam and resultant pointing and tracking requirements is also described. A sample design of a four axes gimbal is conducted and evaluated for different type platform vibration spectra. The vibration spectra is the dynamic input driver which exercises the stabilization and tracking loops during missile pointing and tracking.

Report No.:
JTCG/AS-97-S-001
WL-TR-97-1082

Report Classification:
SECRET

Title: Off Board Laser Countermeasure (OBLCM) Flight Test Demonstration Program

Issued: 14 Feb 1997 Final 8/11/93 - 2/14/97

Sponsor:
Avionics Directorate
Air Force Research Laboratory
WPAFB, OH 45433-7623
POC: R. D. Hunziker, AFRL/SNJ (937) 255-7859 ext. 4025

Performing Organization:
Laser Power Corporation
12777 High Bluff Drive
San Diego, CA 92130

Author(s):
Mr. Roy Autry; Mr. Peter Trost; Mr. Douglas Huggard; Mr. Kenneth Rodriguez

Abstract:

(U) The objective of this effort was to design, develop, fabricate, and flight test the fiber-optic countermeasure concept against a simulated threat laser system. The countermeasure equipment was fabricated and installed in a contractor- supplied Cessna 421C aircraft. The ground threat system included a basic (non-CCM hardened) instrumented missile seeker head mounted on a ground-based gimbal tracker platform. Instead of illuminating the aircraft from the ground, the laser designator spot was simulated by using the output from one of the lasers on board the aircraft. This was operated at the proper code for the seeker to lock onto its output signal. The system logged 8.5 hours of flight time, including 7.1 hours of data flight time encompassing 59 data runs. The effort was sponsored and funded by Wright Laboratory, SAF/AQL, NAVAIR, NRL, and the JTCG/AS. The threat system was fabricated, supplied and operatred by the Precision Guided Weapon Countermeasures Test and Evaluation Directorate (OTD).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-012

Report Classification:
UNCLASSIFIED

Title: Accreditation Support Package for EADSIM, Phase II

Issued: January 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
O'Neal, B.; editor

Abstract:

This Phase II Accreditation Support Package (ASP-II) is intended to provide users of the EADSIM model with confidence that outputs resulting from valid ranges of inputs should be reasonably valid representations of real world conditions and outcomes. The overall objective of ASP-II activities is the identification of that set of problems for which EADSIM is expected to produce reasonable results (the application domain) as well as those functional elements (FEs) that are critical to model level measures of performance (MOPs) and are, therefore, potential targets for detailed V&V efforts. V&V activities that contribute to meeting this objective are divided into two categories:

Logical Verification, which ensures that the basic equations, algorithms, and design of the model are reasonable and correct, and which identifies assumptions and limitations inherent in the implementation; and,
Face Validation, which consists of input data verification and validation, comparison of model outputs with intelligence data and known or best estimates, and a review of sensitivity analysis results.

ASP-II documentation provides software design information in the Conceptual Model Specification (CMS) that supports Logical Verification and Sensitivity Analysis Reports (SARs) that support Face Validation. When coupled with ASP-I information, ASP-II provides the user with the best available confidence level in model results short of detailed, total model V&V, which is addressed in Phase III.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-012

Report Classification:
UNCLASSIFIED

Title: Accreditation Support Package for EADSIM, Phase I

Issued: January 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
O'Neal, B.; editor

Abstract:

This Phase I Accreditation Support Package (ASP I) is designed to provide a potential user with a characterization of the current state of the subject model with respect to criteria related to its general acceptability for use. The information collected in this phase should characterize the model well enough to provide an initial determination of its suitability for a particular application. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications. The information provided to characterize the subject model consists of the following elements:
a.)A description of the configuration management baseline for the model, including version history, current version status, model development policy (including beta site provisions), documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model; b.)A summary of implicit and explicit assumptions and limitations inherent in the model because of its design and/or coding assumptions or structure, as well as any implied constraints to the use of the model that are a consequence of these assumptions or structures. A listing of known errors or anomalies found as a result of prior V&V efforts is also included;c.)A review of the model's development, verification and validation (V&V) and usage histories, as well as a summary of prior accreditations;d.)A review of the status of model documentation and its conformity to accepted software documentation standards, as well as a review of documentation with respect to verification requirements; ande.)A summary of overall software quality as characterized by conformance to accepted design and coding practices.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-011

Report Classification:
UNCLASSIFIED

Title: Accreditation Support Package for BRAWLER, Phase II

Issued: January 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
NaWC, Weapons Division
China Lake, CA 93555-6001

Author(s):
O'Neal, B.; editor

Abstract:

This Phase II Accreditation Support Package (ASP-II) is intended to provide users of the BRAWLER model with confidence that outputs resulting from valid ranges of inputs should be reasonably valid representations of real world conditions and outcomes. The overall objective of ASP-II activities is the identification of that set of problems for which BRAWLER is expected to produce reasonable results (the application domain) as well as those functional elements (FEs) that are critical to model level measures of performance (MOPs) and are, therefore, potential targets for detailed V&V efforts. V&V activities that contribute to meeting this objective are divided into two categories:

Logical Verification, which ensures that the basic equations, algorithms, and design of the model are reasonable and correct, and which identifies assumptions and limitations inherent in the implementation; and,
Face Validation, which consists of input data verification and validation, comparison of model outputs with intelligence data and known or best estimates, and a review of sensitivity analysis results.

ASP-II documentation provides software design information in the Conceptual Model Specification (CMS) that supports Logical Verification and Sensitivity Analysis Reports (SARs) that support Face Validation. When coupled with ASP-I information, ASP-II provides the user with the best available confidence level in model results short of detailed, total model V&V, which is addressed in Phase III.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-011

Report Classification:
UNCLASSIFIED

Title: Accreditation Support Package for BRAWLER, Phase I

Issued: January 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
O'Neal, B.; editor

Abstract:

This first volume of the Accreditation Support Package (ASP-I) is designed to provide a potential user with a characterization of the current status of the subject model with respect to criteria related to its general acceptability for use. The information presented in this volume should characterize the model well enough to provide an initial determination of its suitability for a particular application. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications. The information provided to characterize the subject model consists of the following elements.
a. A description of the configuration management baseline for the model, including version history, current version status, model development policy (including beta site provisions), documentation availability, and a summary of configuration management policies, procedures, guidelines and support functions in place for the model; b. A summary of implicit and explicit assumptions and limitations inherent in the model because of its design and/or coding assumptions or structure, as well as any implied constraints to the use of the model that are a consequence of these assumptions or structures. A listing of known errors or anomalies found as a result of prior V&V efforts is also included; c A review of the model's development, verification and validation (V&V) and usage histories, as well as a summary of prior accreditations; d. A review of the status of model documentation and its conformity to accepted software documentation standards, as well a review of documentation with respect to verification requirements, and;e. A summary of overall software quality as characterized by conformance to accepted design and coding practices.

Report No.:
JTCG/AS-97-M-010

Report Classification:
UNCLASSIFIED

Title: The Road to Credibility: The Final Report of the SMART Project

Issued: March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Hall, D.; editor

Abstract:

This report describes the objectives, approach, costs and results of the five-year Susceptibility Model Assessment and Range Test (SMART) project. This project was funded by the office of the Secretary of Defense (OUSD(A&T)DTSE&E) to develop a cost-effective verification, validation and accreditation (VV&A) process for models and simulations (M&S) used in the system acquisition process. The process was demonstrated on a set of five high-priority M&S used in all three services, and transitioned to the Joint Accreditation Support Activity (JASA) whose mission is to assist system acquisition programs in planning and executing VV&A efforts.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-009

Report Classification:
UNCLASSIFIED

Title: How to VV&A Without Really Trying: Lessons Learned from the SMART Project

Issued: March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Hall, D.; editor

Abstract:

The Susceptibility Model Assessment and Range Test (SMART) project was a five-year effort which developed and tested a comprehensive, cost-effective verification, validation and accreditation (VV&A) process for models and simulations (M&S) used in support of the system acquisition process. In developing and testing the VV&A process, SMART project personnel collected a number of "lessons learned". Those lessons are documented here in a series of semi-independent articles which describe practical advice for planning and executing various elements of the process.

This Lessons Learned document is intended to provide advice to users of M&S in the acquisition community on how to accomplish effective M&S accreditation at minimum cost. It is organized around the same table of contents as the SMART VV&A process description, and it is intended to be a companion to that document. It is hoped that the articles in this document will give the reader valuable insights into practical VV&A applications, and how to put together a cost-effective VV&A program.

The "lessons learned" described in the articles in each section of this document are organized around the top-level work breakdown structure (WBS) elements of the VV&A process. This WBS was developed over the five years of the SMART project, and its elements are the result of a number of demonstrations of the process for actual acquisition program customers. The articles in this document are the lessons gleaned while performing VV&A activities for those real customers.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-008

Report Classification:
UNCLASSIFIED

Title: V&V From A to Z: A SMART Approach to VV&A for Acquisition M&S

Issued: March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P.; editor

Abstract:

As acquisition programs continue to expand the use of modeling and simulation (M&S) to reduce time, resources and risk in the acquisition process, there is a growing need to ensure that the simulations are sufficiently credible for their intended uses. Toward this end, Department of De-fense (DoD) policy requires that simulations be accredited for each major application. The pur-pose of this document is to describe in detail a set of recommended steps that lead to a logically sound and justifiable accreditation decision for simulations used in acquisition applications. These steps are grouped into four major phases: a preparation phase, a planning phase, a verifica-tion and validation (V&V) phase, and an accreditation assessment phase.

The VV&A methodology is presented in a Work Breakdown Structure (WBS) format This format permits VV&A planners to integrate VV&A plans and activities into larger M&S objectives within a program. Each WBS element is defined in terms of required tasking, relevance to the VV&A process, and the contributions of each element to the credibility of the model(s). This structure facilitates employment by acquisition program officials.

The Defense Modeling and Simulation Office (DMSO) has prepared a draft Recommended Practices Guide (RPG) for VV&A. All aspects of the VV&A process presented here are consistent with the RPG. Attention was also paid to making the process consistent with recent DoD and Service directives and instructions regarding M&S management and VV&A, in particular: DoDD 5000.59 and DoDI 5000.61; AR 5-11 (and its relative, DA PAM 5-11); draft SECNAVINST 5200.38; and AFI 16-1001. The format and content of the VV&A products produced by the process described herein have also been standardized. This was done not only to facilitate direct comparison with M&S acceptance criteria derived from analysis of the application, but also to facilitate the integration of summary results into the M&S Resource Repository (MSRR) sponsored by DMSO. Thus, this process, in its entirety, reflects a particularization of the best DoD and Service thinking about VV&A at the levels of both policy and practice with respect to the model(s) used to support weapons systems acquisition.

Report No.:
JTCG/AS-97-M-007
NGIC-1144-104-97

Report Classification:
SECRET

Title: RADGUNS Antiaircraft Artillery Simulation - Version 2.1 Volume 4. Data Manual

Issued: June 1997 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
Systems Directorate - Radar and Air Defense Division
(IANG-SRA)
220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight FitzSimons, Susan Gordon, Steven Swier, Traci McCormick, Richard Alley

Abstract:

(U) Volume 4 contains the classified portion of the RADGUNS Volume 1. User's Manual, Volume 2. Programmer's Manual, and Volume 3. Analyst's Manual. Results of testing conducted at NGIC with the current version for comparison with the user's results are also provided.

Report No.:
JTCG/AS-97-M-006
NGIC-1144-103-97

Report Classification:
UNCLASSIFIED

Title: RADGUNS Antiaircraft Artillery Simulation - Version 2.1 Volume 3. Analyst's Manual

Issued: June 1997 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
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220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight FitzSimons, Dr. Robert Ramey, Susan Gordon, Steven Swier, Traci McCormick, Richard Alley

Abstract:

Volume 3 contains descriptions of individual software routines and methodology employed in the design of the RADGUNS antiaircraft artillery simulation.

Report No.:
JTCG/AS-97-M-005
NGIC-1144-102-97

Report Classification:
UNCLASSIFIED

Title: RADGUNS Antiaircraft Artillery Simulation - Version 2.1 Volume 2. Programmers Manual

Issued: June 1997 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
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Performing Organization:
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220 Seventh St., NE
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Author(s):
Dwight FitzSimons, Susan Gordon, Steven Swier, Traci McCormick

Abstract:

The RADGUNS distribution of software and data allows users to build models of a number of specific ADA systems in support of weapon lethality and airframe survivability assessments.

Volume 2. is intended to provide information necessary for the correct installation and implementation of the software on the user's computer system. This volume provides a list of new features in version 2.1, a list of the materials delivered with the simulation, and instructions for installation and check-out of the software.

Report No.:
JTCG/AS-97-M-004
NGIC-1144-101-97

Report Classification:
UNCLASSIFIED

Title: RADGUNS Antiaircraft Artillery Simulation - Version 2.1 Volume I. Users Manual

Issued: June 1997 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center (NGIC)
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220 Seventh St., NE
Charlottesville, VA 22902-5396

Author(s):
Dwight FitzSimons, Dr. Robert Ramey, Susan Gordon, Charlotte Blair, Steven Swier, Traci McCormick, Richard Alley, Grace Bernardo

Abstract:

Radar-Directed Gun Systems Simulation (RADGUNS) is used to evaluate the effectiveness of air defense artillery (ADA) systems against penetrating aerial targets. It can also be used to evaluate the effectiveness of different airborne target characteristics (RCS, maneuvers, use of electronic countermeasures, etc.) against a specific ADA system. RADGUNS is a complete one-on-one simulation, including weapon system, operators, target model (RCS and Vulnerable areas), flight paths, environment (clutter and multipath), electronic countermeasures, and endgame. Components of each weapon system are modeled at either the subsystem or circuit level, including the acquisition and track radar and optical systems, a set of antiaircraft guns, an FCC, and servo system to aim the guns, and a crew to operate the system. The weapon system models are deterministic, or transfer function type, rather than stochastic (probalistic). Only the endgame is stochastic. Pulse-by-pulse radar receiver models process target (including multipath), jammer, and ground clutter returns. Ph and Pk are calculated using the distribution theory. Volume I is intended to provide information necessary to set up and execute the software on the user's computer systems. the information most important to users in this volume are the Program Operation instructions.

Report No.:
JTCG/AS-97-M-003

Report Classification:
UNCLASSIFIED

Title: BLUEMAX III Ver. 2.0 Analyst's Manual Aircraft Flight Path Generator and Mission Performance Evaluation Model

Issued: March 1997 Final Report April 1996 - March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ASC/XRE, Bldg 11A
2275 D Street, Suite 10
Wright-Patterson AFB, OH 45433-7227

Author(s):
Michael G. Bennett and Stephen H. Ames

Abstract:

This document is the User's Manual for the BLUEMAX III program which provides information and instructions enabling the user to run the model. BLUEMAX III is an aircraft flight path generator and mission performance evaluation computer model. It generates a description of an aircraft's flight status at user-defined time intervals. The model can output these data in numerous formats suitable for input into graphics packages and other end-game models such as RADGUNS and ESAMS. The user controls the aircraft flight profile by either interactively entering commands or preparing a set of automated commands in an input scenario file. Flight profiles can be made over flat earth or over Digital Terrain Elevation Data (DTED) generated by the Defense Mapping Agency (DMA). BLUEMAX III Version 2.0 is an upgrade from the October 1995 release of BLUEMAX III Version 1.0 and includes many new features including aerodynamic enhancements, an expanded automated command set, additional output file types, and to fly Great Circle routes between spherical destination points.

Report No.:
JTCG/AS-97-M-002
SURVIAC TR-97-018

Report Classification:
UNCLASSIFIED

Title: BLUEMAX III Ver. 2.0 Programmers Manual Aircraft Flight Path Generator and Mission Performance Evaluation Model

Issued: March 1997 Final Report April 1996 - March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
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2275 D Street, Suite 10
Wright-Patterson AFB, OH 45433-7227

Author(s):
Michael G. Bennett and Stephen H. Ames

Abstract:

This document is the User's Manual for the BLUEMAX III program which provides information and instructions enabling the user to run the model. BLUEMAX III is an aircraft flight path generator and mission performance evaluation computer model. It generates a description of an aircraft's flight status at user-defined time intervals. The model can output these data in numerous formats suitable for input into graphics packages and other end-game models such as RADGUNS and ESAMS. The user controls the aircraft flight profile by either interactively entering commands or preparing a set of automated commands in an input scenario file. Flight profiles can be made over flat earth or over Digital Terrain Elevation Data (DTED) generated by the Defense Mapping Agency (DMA). BLUEMAX III Version 2.0 is an upgrade from the October 1995 release of BLUEMAX III Version 1.0 and includes many new features including aerodynamic enhancements, an expanded automated command set, additional output file types, and to fly Great Circle routes between spherical destination points.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-97-M-001
SURVIAC TR-97-017

Report Classification:
UNCLASSIFIED

Title: BLUEMAX III Ver. 2.0 Users Manual Aircraft Flight Path Generator and Mission Performance Evaluation Model

Issued: March 1997 Final Report April 1996 - March 1997

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
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Performing Organization:
ASC/XRE, Bldg 11A
2275 D Street, Suite 10
Wright-Patterson AFB, OH 45433-7227

Author(s):
Michael G. Bennett and Stephen H. Ames

Abstract:

This document is the User's Manual for the BLUEMAX III program which provides information and instructions enabling the user to run the model. BLUEMAX III is an aircraft flight path generator and mission performance evaluation computer model. It generates a description of an aircraft's flight status at user-defined time intervals. The model can output these data in numerous formats suitable for input into graphics packages and other end-game models such as RADGUNS and ESAMS. The user controls the aircraft flight profile by either interactively entering commands or preparing a set of automated commands in an input scenario file. Flight profiles can be made over flat earth or over Digital Terrain Elevation Data (DTED) generated by the Defense Mapping Agency (DMA). BLUEMAX III Version 2.0 is an upgrade from the October 1995 release of BLUEMAX III Version 1.0 and includes many new features including aerodynamic enhancements, an expanded automated command set, additional output file types, and to fly Great Circle routes between spherical destination points.

Report No.:
JTCG/AS-96-V-007
USAATCOM TR-97-D-18

Report Classification:
Unclassified

Title: Structural Integrity Determination of a Ballistically Damaged Composite Hub Flexure

Issued: January 1998 FINAL Feb 1997 - May 1997

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS)
Crystal Square #2, Suite 1003
1725 Jefferson Davis Highway, Arlington, VA 22243-5120

Performing Organization:
Aviation Applied Technology Directorate
U. S. Army Aviation and Missile Command
Fort Eustis, Virginia 23604-5577
Sikorsky Aircraft Corporation, 6900 Main Street, Stratford, CN 06601-1381

Author(s):
N. Calapodas and S. Owsley, AATD
Andrew Criscuolo

Abstract:

The objective of the test program described in this report was to establish baseline ballistic damage tolerance data that could be used to develop design criteria for a planned advanced helicopter main rotor hub flexure research program. An RAH-66 Comanche main rotor composite hub flexure (or flexbeam) was subjected to static testing, ballistic damage with design threat, and fatigue testing to assess the effect of battle damage on stiffness and the subsequent growth of the damage due to 1.5g loads.

Prior to fatigue testing the flexbeam, an NDI test was performed to establish its damage level and it was repeated after the fatigue test was repeated after the fatigue test was completed. The initial cracks propagated and new cracks were generated. However, the flexbeam maintained the test loads.

Report No.:
61 JTCG/ME-97-3

Report Classification:
Unclassified

Title: System Requirements Specification (SRS) for the Advanced Joint Effectiveness Model (AJEM)

Issued: December 1997 Final

Sponsor:
JTCG/AS and JTCG/ME

Performing Organization:
Published under the authority of the Chairman of the JTCG/ME under the auspices of the Joint Logistics Commanders

Author(s):
None credited

Abstract:

This System Requirements Specification (SRS) specifies the baseline and long-term requirements for the Advanced Joint Effectiveness Model (AJEM). This document establishes the capability and qualification requirements for AJEM that are necessary to support the lethality/vulnerability/endgame needs of the Army, Navy, Air Force and Joint Technical Coordinating Groups for Aircraft Survivabiltiy (JTCG/AS) and Munitions Effectiveness (JTCG/ME). This SRS provides a description of system requirements that can be communicated to model design specialists. It is not intended to describe how the requirements are implemented. Technical Task Groups designated by the AJEM Steering Committee will design all required modules and document them in system/segment design documents (part of the Analyst Manual). The SRS includes both interface and functional descriptions. The interface description defines the scope, users, and interfaces that connect the AJEM model with events in the outside world. The objective of the functional description is to provide a high level, overall description of major system processes necessary for detailed design studies. AJEM will be a Department of Defense (DoD) standard computer simulation for evaluating the lethality and terminal effectiveness of antiair munitions and the vulnerability of aircraft and missiles, including battle damage repair (BDR). AJEM will produce results that are applicable during all phases of weapon system acquisition from research, design, and development to production test and evaluation. AJEM will provide results that are observable/measurable for testing and real-world events.

Report No.:
USAATCOM TR 97-D-28

Report Classification:
Unclassified

Title: LO Material Operational Usage Evaluation

Issued: October 1997 Final 7/29/93 to 1/31/97

Sponsor:
Aviation Applied Technology Directorate
Aviation Research, Development & Engineering Center (AMCOM)
Fort Eustis, VA 23604-5577

Performing Organization:
Bell Helicopter Textron, Inc.
P.O. Box 482
Fort Worth, Texas 76101-0482

Author(s):
R. B. Williams

Abstract:

Newer helicopters as well as upgrades/modifications to currently fielded helicopters are relying heavily on the use of radar absorbing materials and radar absorbing structures (RAM/RAS). The objective of this program was to assess the durability and reliability and maintainability (R&M) of three OH-58D Desert Storm kit components via extended flight testing while exposed to a variety of weather conditions. Minor modifications, primarily to provide inspection access, were made to the Desert Storm kit design to reduce the maintenance concerns that were identified by the pilots and maintenance personnel. Data including the number of hours flown, weather conditions, pre and post flight visual inspection reports, and any damage sustained was collected and analyzed at periodic intervals. Damage assessments and repairability of these kit components with emphasis on restoring the radar signature integrity of the components were included as part of this program. Pre and post test RCS data was collected on the kit components to establish degradation time lines on the kit materials. Additionally, laboratory mechanical and environmental testing as well as outdoor exposure testing were conducted on the RAM/RAS system panels and coupons.

Report No.:
JTCG/AS-96-V-006
USAATCOM TR-96-D-40

Report Classification:
UNCLASSIFIED

Title: Damage Tolerant Thermoplastic Composite Helicopter Tailboom Structures

Issued: September 1996 Final (8/93 - 12/96)

Sponsor:
U.S. Army Aviation & Troop Command (ATCOM)
Aviation Applied Technology Directorate (AATD)
Fort Eustis, VA 23604

Performing Organization:
Boeing Defense and Space Group
Helicopters Division
P.O. Box 16858
Philadelphia, PA 19142

Author(s):
N. Caravasos, R. Freno, R. Luzersky

Abstract:

A design approach to the problem of lightweight damage tolerant thermoplastic composite structures exposed to HEI internal blast and laser damage is described. The effects of an explosion inside tailboom structures as well as a high energy laser exposure were studied both analytically and experimentally. Configuration were modeled and solved by a nonlinear finite element method. The analysis focused on determining the blast loads, fragmentation damage, and heat damage to be used in the finite element models. Comanche landing loads were initially used to size the structural elements. The CFD code (PHEONICS) was used to model the expanding two- dimensional pressure profile as an initial value problem. These pressures were applied to a cylindrical model of structural tailboom configuration, and displacements and strains were solved. Failures based upon in-plane composite strains and interlaminar shear or tensile strains were predicted. The results were very encouraging inasmuch as all four tailbooms survived both the HEI blast/fragmentation and laser damage effects while testing occurred under load without failing the tailbooms. Minor failures, when they did occur, were due to debond between longerons and skin. Two configurations were designed, a 'soft' skin and a 'hard' skin. All four specimens, two soft and two hard, successfully passed limit load before damage, laser, ballistic (HEI), limit load after damage, and fatigue tests. Residual shear strengths and the degree of correlation between the analytically predicted strains and those measured during the blast tests are discussed.

Report No.:
JTCG/AS-96-V-005
WL-TR-96

Report Classification:
UNCLASSIFIED

Title: Effects of Electromagnetic Interference on Digital Flight Control Systems

Issued: 5 September 1996 FINAL 12/16/89—06/20/96

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability

Performing Organization:
WL/FIGS
2210 Eigth St Ste 11
Wright-Patterson AFB, OH 45433-7521

Author(s):
Bruce T. Clough

Abstract:

This report is a compendium of technical papers written during several electromagnetic vulnerability investigations of digital flight control computers. It covers where problems have been seen and why they occurred. It states hardening suggestions, documents lessons learned, and forecasts future vulnerability for the general class of digital control systems.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-96-V-004
NDC 96-P-0003

Report Classification:
UNCLASSIFIED

Title: Battle Damage Tolerant Composite Wing Structure

Issued: Feb 96 Final

Sponsor:
Naval Air Warfare Center, Aircraft Division
(NAWCAD)
Attn: Code 4331R (David Barrett)
Street & Jacksonville Roads
Warminster, PA 18974-0591

Performing Organization:
McDonnell Douglass Aerospace
P.O. Box 516
St. Louis, MO 63166-0516

Author(s):
Salvatore L. Liguore

Abstract:

Composite usage in high performance fighter/attack aircraft is increasing with each new generation of aircraft. To date, structural applications have focused on exploiting the high strength and stiffness offered by composite materials to reduce the aircraft weight, thereby resulting in improved aircraft performance. With the addition of survivability requirements, composite materials must not only provide weight savings to meet performance requirements, but must also provide improved battle damage tolerance. The Battle Damage Tolerant Composite Wing Structure (BDTCWS) program addressed issues related to the development of survivable composite aircraft wing structure. The program was split into two phases. The primary Phase I tasks were Task I - Analysis Assessment and Improvement, Task II - concept Development and Selection, and Task III - Standardized Test Methodology. In Phase II, the primary tasks were Task IV - Survivability Modeling and Task V - Survivability Testing. The developments and progress of each task are described in this report.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-96-V-003
WL-TR-96-3078

Report Classification:
UNCLASSIFIED

Title: Replica Weapons Bay Design and Vulnerability Reduction Concepts

Issued: March 1996 Final

Sponsor:
Wright Laboratory
Al Kurtz (WL/FIVS)
1901 Tenth St.
Wright-Patterson AFB, OH 45433

Performing Organization:
Veritay Technology, Inc.
4845 Millersport Highway
East Amherst, NY 14051

Author(s):
Edward Fisher, Andrew Crickenberger, Daniel Dawidowicz, James Barnes,
Levelle Mahood*, and Jay Vadnais*
*Northrop Grumman Advanced Design and Technology Center

Abstract:

Federal law mandates live fire testing of new or upgraded weapons systems before full-rate production. Since the systems must be configured with combat loads, vulnerability of munition stores is being emphasized. Combat aircraft, both fixed-wing and rotary-wing, fall under the auspices of the live fire test law.

In support of this mandate, a program was initiated to characterize munitions response and evaluate weapons bay hardening/event mitigation technologies. As part of this program, the Weapons Bay Vulnerability Reduction project was formulated with two main objectives: (1) to formulate a base of relevant information pertaining to munition response characteristics and associated phenomena, aircraft weapons bay configurations and munition loadings, and event detection and event mitigation/bay hardening concepts; and (2) to develop the design for a replica weapons bay in which weapons bay response to initiated munitions can be evaluated experimentally during survivable bay development as a precursor to successful live fire tests.

Using the information base, the replica bay design features modularity and use of commercially available, off-the-shelf components and materials. The design incorporates robust construction materials for survivability and the modularity feature allows a wide range of weapons bays to be configured using an erector-set approach.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-96-S-003
WL-TR-96-1144

Report Classification:
SECRET

Title: Advanced Expendable Laser Jammer Field Tests (U)

Issued: October 1996 Final 8/7/89 - 9/30/96

Sponsor:
Wright Laboratory - Avionics Directorate
Air Force Material Command
WPAFB, OH 45433-7304
POC: Mr. R. Hunziker, WL/AAJW, 937 255-4174

Performing Organization:
Sanders, A Lockheed-Martin Company
P.O. Box 2057
Nashua, NH 03061-2057

Author(s):
Kevin Ezzo, Dr. John Kuppenheimer

Abstract:

(U) The objective of this effort was to investigate, design, fabricate, and test an advanced version of the expendable laser jammer. New technological developments have recently been made that make it reasonable that laser aided weapon systems (i.e., anti-aircraft laser designators and laser tracker/range finders used with RF/IR guided missiles or AA) will be developed and deployed. the report covers several versions that are in development. The expendable laser jammer will be used to compete with the reflected signal off of the attacked aircraft and act as a decoy as it falls away from the aircraft, or act as a jammer as long as it is within the field of view of the jammer. The AELJ was field tested at White Sands Missile Range for effectiveness against a witness seeker. The results obtained by the Presision Guided Weapon Test and Evaluation Directorate (OTD) at WSMR can be found in an independent report OTD-TR-1-96.

Report No.:
JTCG/AS-96-S-002
WL-TR-95-1155

Report Classification:
SECRET-NOFORN

Title: Laser Beamrider Missile Countermeasure Parameterization.

Issued: October 1995 Final 8/6/90 - 10/9/95

Sponsor:
Avionics Directorate
Wright Laboratory
Air Force Material Command
Wright Patterson, AFB, OH 45433-7409

Performing Organization:
Lockheed Sanders, Inc.
95 Canal St
P.O. Box 2057
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Author(s):
Dr. J. D. Kuppenheimer, S. Buchholz

Abstract:

The abstract is classified.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-96-S-001
PR F18-0027

Report Classification:
SECRET - NOFORN

Title: Pointing and Tracking Countermeasures (U)

Issued: June 1995 Final 07/07/92 - 08/07/95

Sponsor:
Avionics Directorate
Wright Laboratory
Air Force Materiel Command
Wright Patterson AFB, OH 45433-7409

Performing Organization:
Hughes Danbury Optical Systems, Inc.
Albuquerque Engineering Laboratory
1600 Randolph Court, S.E.
Albuquerque, NM 87106

Author(s):

Abstract:

(U) The Pointing and Tracking Countermeasures (P&TCM) program designed, developed, and demonstrated, new and innovative countermeasure techniques/concepts to negate threat directed energy weapon pointing and tracking systems. This document reviews the P&TCM program efforts.

Report No.:
JTCG/AS-96-M-002

Report Classification:
UNCLASSIFIED

Title: Preliminary Accreditation Support Package for Joint Service Endgame Model (JSEM) ASP I

Issued: December 1996 Preliminary

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS)
Crystal Square #2, Suite 1003
1725 Jefferson Davis Highway
Arlington, VA 22202-4102

Performing Organization:
Joint Accreditation Support Activity (JASA)
Naval Air Warfare Center Weapons Division
China Lake, CA 93555-6001

Author(s):
Hall, D. H.; Saitz, D. and Kappleman, L.

Abstract:

This is an initial version of the Accreditation Support Package Volume I (ASP-I) for the Joint Services Endgame Model (JSEM). It is designed to provide a potential user with a characterization of the current state of JSEM with respect to the criteria related to its general acceptability for use. The information collected here should characterize the model well enough to provide an initial determination of its suitability for particular applications. It should also provide confidence that the model is well enough managed and supported to yield consistent results across its spectrum of users and applications.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-96-M-001
SURVIAC-TR-95-019

Report Classification:
UNCLASSIFIED

Title: Vulnerability Analysis/Combat Data Correlation - Phase II Final Report

Issued: October 1995 Final November 1994 - October 1995

Sponsor:
ASC/XREC
1970 Third Street, Suite 2
Building 11A
Wright-Patterson AFB, OH 45433-7209

Performing Organization:
WL/FIVS/SURVIAC
2130 8th Street Suite 1
Wright-Patterson AFB, OH 45433-7209

Author(s):
Frederick, Scott

Abstract:

Vulnerability analyses are used to evaluate the "toughness" of aeronautical systems and as a major input to survival analyses. The analyses are subsequently used to evaluate tactics effectiveness, compare relative aircraft survivability, and to develop acceptable hardness levels for new aircraft designs. The analysis techniques have been developed over the course of many years. the penetration equations and component vulnerabilities are "calibrated" with test data and actual combat data. While test data is more precise, actual combat data represents "real life" results which can be used to assure that the analyses are credible and closely track the real experiences found in combat.

Under this contract the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) sponsored an evaluation of existing computer programs for performing endgame analyses. This report summarizes the results of a combat damage data correlation study using a computer endgame model. The combat data was used from the Gulf War and Southeast Asia.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-V-008
WL-TR-96-3050

Report Classification:
UNCLASSIFIED

Title: Survivability Enhancement of Optical Fiber Data Busses by Structural Integration

Issued: September 1995 Final September 93 - September 95

Sponsor:
Vincent W. Crum, (WL/FIGS) (513) 255-8428
Wright Laboratory
Wright-Patterson Air Force Base, OH 45433-7521

Performing Organization:
Dr. Kent A. Murphy
Fiber & Sensor Technology, Inc.
P.O. Box 11704
Blacksburgh, VA 24062

Author(s):
Stephen H. Poland, Dr. Adel Sarra Fzadeh-Khoee, Jennifer Grace, Mark Alcock, Dr. Kent Murphy, Russel G. May, Dr. Richard O. Claus

Abstract:

To support the efforts of the Joint Technical Coordinating Group on Aircraft Survivability, under an Air Force Phase II SBIR program, "Survivability Enhancement of Optical Fiber Data Busses by Structural Integration," Fiber & Sensor Technologies, Inc. (F&S) of Blacksburg, VA developed advanced cable designs and instrumentation which provide enhanced survivability of avionic fiber optic data busses.

Under the SBIR program, F&S has developed a highly survivable pultruded composite cable design which has a very high toughness, resists impact damage due to ballistic and tool dropping impacts, is lightweight (7.0x10-3lb/foot) and can withstand a maximum pull tension force of 400 lbs. Testing of the cable assemble transfers only 7% of external tensile strains to optical fibers within the assembly which correlates to over 5000% improvement in the predicted lifetime of the optical fibers.

for the SBIR F&S has also developed an Optical Time Domain Reflectometer (OTDR) - based avionic cable harness diagnostic system which can remotely locate overstrained cable sections along in-service fiber optic avionic data busses. The system can be used to measure the lengths of individual sections in cable harness by precisely measuring the distances between avionic air-gap connectors (such as MIL-C-38999 or MIL-C-83723). By using the diagnostic system during on-schedule maintenance procedures, overstrained fiber optic cables may be identified and replaced prior to mechanical failure.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-V-007
ARL-TR-755

Report Classification:
UNCLASSIFIED

Title: Joint Technical Coordinating Group on Aircraft Survivability Inter Laboratory Ballistic Test Program

Issued: June 95 Interim TR FY93 - FY94

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Research Laboratory
Materials Directorate
Watertown, MA 02172-0001

Author(s):
John H. Graves, AMSRL-MA-CC; and Capt. Hermann Kolev, USA, Dept of Mathematical Sciences, US Military Academy

Abstract:

Analysis of experimental data from inter laboratory ballistic tests indicate that results from different facilities are not fully comparable for each of the two armor materials tested. The Materials Directorate of the Army Research Laboratory (ARL•MD) provided each of the nine laboratories participating in this program with a set of metallic armor panels and a set of macrocomposite armor panels consisting of a ceramic adhesively bonded to Kevlar® reinforced plastic. ARL•MD stipulated the velocity for the first projectile fired at each set of armor panels and an obliquity of 0°. The lead test engineer at each laboratory selected all subsequent velocities. Each laboratory shot a series of ARL•MD provided U.S. 0.50 caliber armor piercing (AP) M2 projectiles at the panels and calculated a V_{50} protection ballistic limit (PBL) in accordance with MIL-STD-662E. In this report, we present the results from each laboratory for both armor panel t types on which we performed two different statistical analyses. We also include a series of recommendations for improving the reproducibility of inter laboratory ballistic test data.

Report No.:
JTCG/AS-95-V-006
NAWCWPNS TP 8235

Report Classification:
CONFIDENTIAL

Title: Specifications and Verification Test Procedures To Improve Fuel Ingestion Tolerance of Turbine Engines

Issued: October 1995 Final FY1992 -FY1995

Sponsor:
Naval Air Warfare Center Weapons Division
Attn: Les Throndson, C418200D
China Lake, CA 93555-6001

Performing Organization:
ASI Systems International, Inc.
825 N. Downs
Ridgecrest, CA 93555
(619) 375-1442

Author(s):
Gary R. Burgner

Abstract:

This report doucments the author's recommendations for specifications and procedures to be used in tests of flammables ingestion testing of aircraft gas turbine engines. The failure of engines as a result of ingestion of fuel and other flammables accounts for a substantial fraction of all combat aircraft losses and more than a few peacetime accidents as well. The survivability community has conducted tests for many years to assess engines' tlerances to fuel ingestion. New procurement specifications requiring engines to exhibit certain tolerances to fuel ingestion will require tests to verify that the specifications are met before engines are procurred. Use of the specifications and procedures recommended herein will assure that the best available experience and understanding of the ingestion problem are applied. The recommendations made here are subject to revision as more test experience accrues.

This project's objective is the engineering of means of reducing engine and aircraft vulnerability to fuel ingestion procurement specifications. The author was the project manager for VP-2-01, designed and conducted fuel-ingestion tests from 1984 to 1993, and has been involved with gas turbine propulsion for missiles and aircraft since 1967. Subsequent to his retirement from civil service, he was employed by ASI Systems International, where he completed this report under contract N60530-91-D-0022. The report was reviewed for accuracy by Charles E. Frankenburger and Lester W. Throndson.

Report No.:
JTCG/AS-95-V-005
TM 7877

Report Classification:
UNCLASSIFIED

Title: Ballistic Tests of Composite Case Rocket Motors & Rocket Motors with Bore Mitigant Foam

Issued: May 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Budd, Leo

Abstract:

(U) High explosives and rocket propellants in munitions onboard aircraft present vulnerable areas, which, if impacted by ballistic threats, may result in the loss of an aircraft. The testing described in this report was conducted at the Weapons Survivability Laboratory (WSL) of the Naval Air Warfare Center Weapons Division (NAWCWPNS) China Lake, California, to evaluate the responses of composite case rocket motors to ballistic impacts and to evaluate the feasibility of preventing delayed deflagrations in rocket motors by installing bore mitigant foam.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-V-004
FR 23802-1

Report Classification:
UNCLASSIFIED

Title: Engine Battle Damage Repair (EBDR) Study (Phase I) Final Report

Issued: 12 MAY 1995 FINAL - RESEARCH

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
United Technologies Corporation
Pratt & Whitney/ Govt Eng & Space
P O Box 109800
West Palm Beach, FL 33410-9500

Author(s):
Mr. Jim Shipman, Mr. Chris Parmley, P&W; Mr. Ron Levy, SURVICE Eng.;
Mr. Les Throndson, NAWCWPNS China Lake (Govt Coordinator)

Abstract:

This is the first of three study reports that explore the feasibility of air-breathing turbine engine battle damage accommodation and repair on a wide range of engines. This particular report describes the collection, organization and evaluation of combat and live fire test damage into a "living" electronic database which will help in the selection of candidate repair components in the near term and future. Relevant information such as components damaged, type damage, penetration depths, frequency of damage occurrence, degree of engine incapacitation and a preliminary estimate of repair risk is included in this database. Later contract periods will require work to define and recommend approaches to expeditiously repair various types of damage noted in this report. This report also contains a preliminary roadmap for establishment of an EBDR development process which will be integrated into the total aircraft battle damage repair process. The objective of this and subsequent related work is to develop alternatives to the current EBDR approach which consists of "remove and replace" maintenance.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-V-004
FR 23802-4

Report Classification:
UNCLASSIFIED

Title: Engine Battle Damage Repair (EBDR) Study Final Report, Volume I, II, and III EXECUTIVE SUMMARY

Issued: 15 January 1997 FINAL 3/19/96 - 1/15/97

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
United Technologies Corporation
Pratt & Whitney/ Govt Eng & Space
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West Palm Beach, FL 33410-9500

Author(s):
Mr. Jim Shipman, Mr. David O'Brian, Mr. Chris Parmley, P&W; Mr. Robert Baumgarten, P&W; Mr. Les Throndson, NAWCWPNS China Lake (Govt Coordinator)

Abstract:

This Executive Summary report documents an Engine Battle Damage Repair (Engine BDR) feasibility study performed under contract to the U.S. Navy (contract #N68936-94-C-0317). This study was performed in three stages, a Basic Contract Period (Phase I) and two optional periods (phases II and III), and explored the feasibility of performing battle damage repair and accommodation on a wide range of airbreathing military turbine engines. The primary efforts of Phase I included turbojet, turbo fan and turbo shaft engine damage characterization from combat and ballistics test data and creation of a preliminary Engine BDR process. The Phase II effort consisted of the creation of general engine BDR repairability guidelines intended to extend engine BDR capability beyond those available under the current "remove and replace" maintenance philosophy. This effort also included a risk/payback analysis of engine component BDR applications derived from guidelines to determine the prime candidates for Phase III development. Phase III detailed conceptual repair procedures for six BDR repair scenarios and identified materials, damage assessment aids, tooling and equipment necessary to perform the repairs. This study showed major opportunities for Engine BDR.

Report No.:
JTCG/AS-95-V-004
FR 23802-3

Report Classification:
UNCLASSIFIED

Title: Engine Battle Damage Repair (EBDR) Study Final Report Volume III

Issued: 15 January 1995 Final 3/19-96 - 1/15/97

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
United Technologies Corporation
Pratt & Whitney/ Govt Eng & Space
P O Box 109800
West Palm Beach, FL 33410-9500

Author(s):
Mr. Jim Shipman, Mr. David O'Brien, Mr. Chris Parmley, P&W; Mr. Robert Baumgarten; Mr. Les Throndson, NAWCWPNS China Lake (Govt Coordinator)

Abstract:

This is the third volume of a three volume report for a study exploring the feasibility of performing batle damage accommodation and repair on a wide range of air breathing turbine engines. this particular report describes the detailed repair procedures for six BDR repair scenarios identified in Volume II as high/payback/low risk opportunities. Materials, damage assessment aids, tooling and equipment necessary for planning and accomplishing the specific engine BDR Process for directing future developmnent practices which is identified to be integrated into the overall aircraft battle damage repair process. The objective of this and previous related work is to develop alternatives to the current engine BDR approach which consists primarily of "remove and replace" maintenance.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-V-004
FR 23802-1

Report Classification:
UNCLASSIFIED

Title: Engine Battle Damage Repair (EBDR) Study Final Report VOLUME II

Issued: 8 MAY 1995 FINAL - 5/18/95-3/19/96

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
United Technologies Corporation
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P O Box 109800
West Palm Beach, FL 33410-9500

Author(s):
Mr. Jim Shipman, Mr. David O'Brian, Mr. Chris Parmley, P&W;
Mr. Les Throndson, NAWCWPNS China Lake (Govt Coordinator)

Abstract:

This is the second volume of a three volume report for exploring the feasibility of air-breathing turbine engine battle damage accommodation and repair on a wide range of engines. This particular report describes the creation of general turbofan and turboshaft engine BDR principles and approaches (including damage assessment, accomodation, and repair). These engine BDR guidelines were derived from combat and ballistics test damage data collected during the previous project phase and from P&W engine manufacture, development, and field expertise. This report also contains a preliminary Engine BDR Process for directing future development practices which is intended to be integrated into the overall aircraft battle damage repair process. The objective of this and subsequent related work is to develop alternatives to the current engine BDR approach which consists primarily of "remove and replaaace" maintenance.

Report No.:
JTCG/AS-95-V-002
NSWCDD TR-95-132

Report Classification:
UNCLASSIFIED

Title: Ablative and Thermal Barriers for Aircraft Dry Bays

Issued: September 1995 Progress - Oct 1992 - June 1995

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center
Dahlgren Laboratory, Code G22
Dalhgren, VA 22448-5100

Author(s):
Benjamin D. Smith, NSWC Dahlgren; Kenneth A. Musselman, NSWC Dahlgren; Alex Kurtz, Wright Laboratory

Abstract:

The next generation of "stealthy", fixed and rotary wing aircraft will incorporate internal carriage of ordnance. Ablative and thermal barrier materials are required to protect against burning rocket motors. commercial and prototype ablative and thermal barrier materials are surveyed, their property data summarized, and previous aircraft applications cited. These barrier materials will "harden" weapon dry bays, bulkheads, doors, munitions racks, ejection mechanisms and aircraft flight control lines so that they can withstand the initial burning event and permit mitigating actions to occur. Applications to weapons bays require additional test and evaluations of candidate barrier materials. Recommended follow-on programs are to evaluate quantitatively barrier materials against rocket motor gases and plumes, optimize thermal barrier material systems to minimize weight, volume and material thickness penalties, and conduct generic dry by tests to demonstrate and validate all protection components, barriers, sensors, mitigating concepts as a system.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-S-002
Report No. 9502281

Report Classification:
UNCLASSIFIED

Title: Methodology for Incoherent IRCM Measurements

Issued: 28 February 1995 Final

Sponsor:
Naval Research Laboratory
Optical Sciences Division
Applied Optics Branch, Code 5631

Performing Organization:
David H. Pollock Consultants, Inc.
166 Fairview Avenue, Suite D
Westwood, NJ 07675

Author(s):
David H. Pollock

Abstract:

A methodology is presented to establish a common means to measure radiative performance of incoherent infrared countermeasure systems. A calibration procedure is also described. Generic pulse waveforms are defined for conducting the measurements. A critical aspect of these types of measurements is to account for effects of atmospheric attenuation on the radiative performance. This methodology prescribes co-locating the calibration blackbody source and the IRCM source to be characterized. This co-location allows the ultimate cancellation of atmospheric transmission terms. The resultant radiant intensity of the unknown source is a function of the radiometer readings of the blackbody and unknown source and a calibration constant.

Report No.:
JTCG/AS-95-S-001
LPR-95-001

Report Classification:
UNCLASSIFIED

Title: Low Profile Laser Threat Warning Sensor

Issued: 15 November 1994 Final (July 1992 - Sept 1994)

Sponsor:
Commander, U.S. Army CECOM NVESD
Allen Chan, AMSEL-RD-NV-SE-EOIR
Pearl Harbor Drive, Bldg 2705
Ft. Monmouth, NJ 07703-5206

Performing Organization:
Laser Power Research
12777 High Bluff Drive
San Diego, CA 92130

Author(s):
Douglas E. Breckinridge, Graham Flint

Abstract:

The proliferation of laser guided weapon systems to a multitude of potential foes makes it highly probable that US Army forces will encounter such weapons in the future. Presently deployed laser warning receivers are complex, fragile, expensive, and bulky. In this report, characteristics of a fiber-optic fed warning receiver are described which presents an extremely low profile on the vehicle surface and is both lightweight land durable. the system consists of multiple individual sensors, each with field of view of 1.8 steradians, to be arranged on a vehicle for complete hemispherical coverage. Multiple sensors provide for a low system false alarm rate (<1 per day). A novel optical coupling system allows for ease of field replacement. Experimental ldata using a single-shot designator source indicates angular resolution of better than 3 degrees at a peak intensity level of 0.5 W/CM2 @ 1064nm optical wavelength, providing useful angle information in a threat-illuminated environment. Employing basic detector design and signal processing technology provides for a compact, reliable, and low cost system.

Report No.:
JTCG/AS-95-M-024
NGIC-1144-103-96

Report Classification:
UNCLASSIFIED

Title: Radar-Directed Gun Systems Simulation RADGUNS Antiaircraft Artillery Simulation — Version 2.0 Volume 3. Methodology and Design Manual

Issued: February 1996 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center
Research and Analysis Directorate, Air Combat Division (IANG-SAC)
220 Seventh St., NE, Charlottesville, VA 222901-5396

Author(s):
NGIC - D. FitzSimons, Dr. Ramey, S. Gordon, C. Blair; NAWCWPNS - C. Knecht; NAIC 3/19/96 Capt Bustle; ASI - D. Bower, S. Swier, C. Ruddy

Abstract:

(U) RADGUNS is a complete one-on-one simulation, including weapon system, operators, target model (radar cross section and presented/vulnerable areas), flight paths, environment (clutter and multipath), electronic attack, and end game. Components of each weapon system are modeled at either the subsystem oar circuit level including the search and track radar systems, a set of antiaircraft guns, a fire-control computer /servo system to aim the guns, and a crew to operate the system. The weapon system models are deterministic (or transfer function type), with only the end-game being stochastic (probabilistic). Pulse-by-pulse radar receiver models process the returns from the target (including multipath effects) and ground clutter. The fire control computer (FCC) model predicts super elevation and lead angles based upon the (radar or optical) tracker's target position. The gun model fires and traces each round out to the target so that miss distance may be calculated. Probabilities of hit and kill are then calculated using distribution theory.

Report No.:
JTCG/AS-95-M-023
NGIC-1144-102-96

Report Classification:
SECRET NOFORN

Title: Radar-Directed Gun Systems Simulation RADGUNS Antiaircraft Artillery Simulation — Version 2.0 Volume 2. Supplement to User Manual

Issued: February 1996 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
National Ground Intelligence Center
Systems Directorate, Air Combat Division (IANG-SAC)
220 Seventh St., NE, Charlottesville, VA 222901-5396

Author(s):
NGIC - D. FitzSimons, Dr. Ramey, S. Gordon, C. Blair; NAWCWPNS - C. Knecht; NAIC 3/19/96 Capt Bustle; ASI - D. Bower, S. Swier, C. Ruddy

Abstract:

(U) RADGUNS is a complete one-on-one simulation, including weapon system, operators, target model (radar cross section and presented/vulnerable areas), flight paths, environment (clutter and multipath), electronic attack, and end game. Components of each weapon system are modeled at either the subsystem oar circuit level including the search and track radar systems, a set of antiaircraft guns, a fire-control computer /servo system to aim the guns, and a crew to operate the system. The weapon system models are deterministic (or transfer function type), with only the end-game being stochastic (probabilistic). Pulse-by-pulse radar receiver models process the returns from the target (including multipath effects) and ground clutter. The fire control computer (FCC) model predicts super elevation and lead angles based upon the (radar or optical) tracker's target position. The gun model fires and traces each round out to the target so that miss distance may be calculated. Probabilities of hit and kill are then calculated using distribution theory.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-022
NGIC-1144-101-96

Report Classification:
UNCLASSIFIED

Title: Radar-Directed Gun Systems Simulation RADGUNS Antiaircraft Artillery Simulation — Version 2.0 Volume 1. User Manual

Issued: February 1996 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NGIC Systems Directorate
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220 Seventh St., NE
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Author(s):
NGIC - D. FitzSimons, Dr. Ramey, S. Gordon, C. Blair; NAWCWPNS - C. Knecht; NAIC 3/19/96 Capt Bustle; ASI - D. Bower, S. Swier, C. Ruddy

Abstract:

RADGUNS is a complete one-on-one simulation, including weapon system, operators, target model (radar cross section and presented/vulnerable areas), flight paths, environment (clutter and multipath), electronic attack, and end game. Components of each weapon system are modeled at either the subsystem oar circuit level including the search and track radar systems, a set of antiaircraft guns, a fire-control computer /servo system to aim the guns, and a crew to operate the system. The weapon system models are deterministic (or transfer function type), with only the end-game being stochastic (probabilistic). Pulse-by-pulse radar receiver models process the returns from the target (including multipath effects) and ground clutter. The fire control computer (FCC) model predicts super elevation and lead angles based upon the (radar or optical) tracker's target position. The gun model fires and traces each round out to the target so that miss distance may be calculated. Probabilities of hit and kill are then calculated using distribution theory.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-016

Report Classification:
UNCLASSIFIED

Title: A Software Quality Assessment Process for DoD Models and Simulations

Issued: October 1995 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ASI Systems International
825 N. Down
Ridgecrest, CA 93555-6001

Author(s):
O'Neal, B; Cook, A.

Abstract:

The software quality assessment (SQA) process described here is intended to support the accreditation of models and simulations (M&S) by analyzing the structure and content of source code from a software engineering perspective. Guidance is provided to assist evaluators with different backgrounds to come to the same general quality assessment results.

Accreditation of a model for use in a particular application will be accompanied by risks in the following areas:

1. Appropriate functionality of the software and production of desired, valid outputs,
2. Ease of use and cost-effective maintainability,
3. Computer and interface resource requirements,
4. Efforts required to support verification, and
5. Feasibility of modification, if necessary to support intended uses.

The first of these is addressed by aspects of validation functions that can be performed at various levels of detail. The second is a function of user and technical support documentation quality as well as the effectiveness of configuration management (CM) policies and procedures in place for the particular model. The remaining three areas can be supported to some degree by the SQA process described here. Assessments of software quality address risks associated with usability, maintainability, and portability as well as potential verification and validation (V&V) efforts that may be required to establish model suitability and credibility.

This SQA process can be tailored to the accreditation requirements of a particular application, or resources available, but should attempt to address areas of quality applicable to the scope of use. Suggestions are provided that cover most of the areas deemed important by users of M&S that support analysis of weapon systems and/or aircraft survivability, because those have been examined by the SMART Project. Users of other types of M&S may not have a need to be concerned with modification and maintainability issues, for example, if M&S under consideration are supported by an existing infrastructure that facilitates change, V&V, and regular updates of capability. SQA results will be most critical for M&S that have not been subjected to extensive V&V efforts, but seek accreditation by programs and acceptance in user communities.

Results of SQA are intended to support M&S suitability decisions via inclusion in the Phase I Accreditation Support Package (ASP-I) devised by the SMART Project. Accreditation decisions based upon information are analogous to Level I accreditations described in OI-16.01 published by the Air Force Information Warfare Center (AFIWC). Determination of M&S suitability for a particular application at this level address issues relative to model usage history, V&V status, documentation and software quality, and configuration management (CM).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-015
NAWCWPNS TP 8266

Report Classification:
UNCLASSIFIED

Title: Summary Report of the 1994 Aircraft Vulnerability Survey

Issued: November 1995 Final: October 1993-September 1994

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability
Naval Air Systems Command (AIR 4.1.8)
1421 Jefferson Davis Highway
Arlington, VA 22243-5120

Performing Organization:
Naval Air Warfare Center Weapons Division
China Lake, CA 93555-6001

Author(s):
Systems Evaluation Branch, Systems Engineering Department

Abstract:

(U) The research described in this report was performed at the Naval Air Warfare Center Weapons Division, China Lake, California (Code 418100D), during fiscal year 1994 as part of an effort to delineate and quantify the software tool needs and requirements of the vulnerability analysis community. This report details the results of the vulnerability survey and the analysis methodology used to quantify the survey data. A sample survey, along with raw data, is included in the appendixes to this document, and the survey database is contained on the enclosed diskette.

Report No.:
JTCG/AS-95-M-014

Report Classification:
UNCLASSIFIED

Title: Phase III Accreditation Support Package for the Radar Directed Gun System Simulation (RADGUNS) (U)

Issued: June 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Krenz, T.; McCormick, T.; O'Neal, B.; Ross, V.

Abstract:

This document summarizes the results of detailed verification and validation (V&V) efforts applied to RADGUNS so that users or evaluators can establish the degree to which the intended software design is implemented in code and the degree to which model functionality replicates performance of radar systems under test conditions. Verification reports for functional elements (FEs) of the model are presented in section 2 along with discrepancies noted by independent agents. Validation results for FEs (in section 3) provide comparisons between lower level functions (e.g., antenna patterns, filters) and measurements made on actual systems in a controlled environment. Top, or model level results (in section 4) examine comparisons between model predictions and observed phenomena during operational or integrated testing of radar systems. Where possible, sources of discrepancy are identified and model deficiencies are documented. The degree to which the V&V information provided addressees requirements for intended use of the model will either facilitate its accreditation or identify further efforts needed to accredit it for use in a particular application.

JTCG/AS BIBLIOGRAPHY

Report No.: **JTCG/AS-95-M-013**

Report Classification: **UNCLASSIFIED**

Title: Phase II Accreditation Support Package for the Radar Directed Gun System Simulation (RADGUNS) (U)

Issued: January 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Krenz, T.; McCormick, T.; O'Neal, B.; Ross, V.

Abstract:

This document is designed to provide inputs to logical verification and face validation activities performed by subject matter experts (SMEs) or prospective users with a need to establish confidence that RADGUNS inputs and outputs are reasonable valid representations of real world conditions and outcomes. Logical verification, which ensures that basic equations, algorithms, and design of the software are reasonable and correct, and which identifies assumptions and limitations inherent in the implementation is supported by the Conceptual Model Specification (CMS) that comprises section 2. Face validation, which consists of input data verification and validation (V&V), comparison of model outputs with intelligence data and known or best estimates, and an analysis of model behavior is supported by sensitivity analysis results that are presented in section 3. Information provided should allow a panel of SMEs or knowledgeable users to identify specific functions that require further examination or V&V to properly address requirements for intended applications as well as those of interest. The degree to which the software design and sensitivity information provided satisfies requirements for intended use of the model should serve to facilitate its accreditation as well as scope further V&V efforts that may be deemed necessary.

Report No.: **JTCG/AS-95-M-012**

Report Classification: **UNCLASSIFIED**

Title: Phase I Accreditation Support Package for the Radar Directed Gun System Simulation (RADGUNS) (U)

Issued: May 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Ellis, S.; Krenz, T.; Lapman, G.; O'Neal, B.; Ross, V.

Abstract:

This document is designed to provide potential users with a characterization of the current state of RADGUNS with respect to criteria related to its general acceptability for use. Information collected during execution of Phase i accreditation support activities by an array of contractors is presented in sections that address the following: 1) configuration management (CM) policies, procedures, guidelines, and support functions along with a description of the current version and its development history; 2) a summary of assumptions and limitations inherent in the model design or implementation and a listing of known errors that might impact intended usage; 3) a review of the verification and validation (V&V) efforts applied to the model and a history of its use in study or analysis projects; 4) an assessment of documentation quality with emphasis on requirements for V&V that might be required; and 5) an assessment of software quality with respect to accepted standards and practices that could mitigate risks associated with intended or required modification or development efforts. The degree to which the information provided meets requirements for intended use of the model serves to facilitate further consideration or rejection of it as a potential candidate for accreditation.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-011

Report Classification:
Secret/Noforn/WNINTEL

Title: Phase III Accreditation Support Package for the Enhanced Surface to Air Missile Simulation (ESAMS) (U)

Issued: September 1995 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Born, G.; Hancock, J.; O'Neal, B; Silco, T.

Abstract:

(U) This docuemnt summarizes the results of detailed verification and validation (V&V) efforts applied to ESAMS so that users or evaluators can establish the degree to which the intended software design is implemented in code and the degree to which model functionality replicates performance of radar systems under test conditions. Verification reprots for functional elements (FEs) of the model are presented in section 2 along with discrepancies noted by individual agents. Validation results for FEs (in section 3) provide comparisons between lower level functions (e.g., antenna patterns, filters) and measurements made on actual systems in a controlled environment. Top, or model level results (in sectin 4) examine comparisons between model predictions and observed phenomena during operaitonal or integrated testing of radar systems. Where possible, sources of discrepancy are identified and model deficiencies are documented. The degree to which the V&V information provided addresses requirements for intended use of the model will either facilitate its accreditation or identify further efforts needed to accreditr it for use in a particular application.

Report No.:
JTCG/AS-95-M-010

Report Classification:
Secret/Noforn/WNINTEL

Title: Phase II Accreditation Support Package for the Enhanced Surface to Air Missile Simulation (ESAMS) (U)

Issued: December 1995 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Born, G.; Hancock, J.; O'Neal, B; Silco, T.

Abstract:

(U) This document is designed to provide inputs to logical verification and face validation activities performed by subject matter experts (SMEs) or prospective users with a need to establish confidence that ESAMS inputs and outputs are reasonably valid representations of real world conditions and outcomes. Logical verification, which ensures that basic equations, algorithms, and design of the software are reasonable and correct, and which identifies assumptions and limitations inherent in the implementation is supported by the Conceptual Model Specification (CMS) that comprises section 2. Face validation, which consists of input data verification and validation (V&V), comparison of model outputs with intelligence data and known or best estimates, and an analysis of model behavior is supported by sensitivity analysis results that are presented in section 3. Information provided should allow a panel of SMEs or knowledgeable users to identify specific functions that require further examination or V&V to properly address requirements for intended applications as well as those of interests. The degree to which the software design and sensitivity information provided satisfies requirements for intended use of the model should serve to facilitate its accreditation as well as scope further V&V efforts hat may be deemed necessary.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-009
None

Report Classification:
UNCLASSIFIED

Title: Phase I Accreditation Support Package for the Enhanced Surface to Air Missile Simulation (ESAMS) (U)

Issued: December 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P.R.; Cheek, K., LTC; Hamilton, L.; Hancock, J.; Ellis, S.; Lapman, G.

Abstract:

This document is designed to provide potential users with a characterization of the current state of ESAMS with respect to criteria related to its general acceptability for use. Information collected during execution of Phase I accreditation support activities by an array of contractors is presented in sections that address the following: 1) configuration management (CM) policies, procedures, guidelines, and support functions along with a description of the current version and its development history; 2) a summary of assumptions and limitations inherent in the model design or implementation and a listing of known errors that might impact intended usage; 3) a review of the verification and validation (V&V) efforts applied to the model and a history of its use in study or analysis projects; 4) an assessment of documentation quality with emphasis on requirements for V&V that might be required; and 5) an assessment of software quality with respect to accepted standards and practices that could mitigate risks associated with intended or required modification or development efforts. The degree to which the information provided meets requirements for intended use of the model serves to facilitate further consideration or rejection of it as a potential candidate for accreditation.

Report No.: JTCG/AS-95-M-008

Report Classification: UNCLASSIFIED

Title: Phase III Accreditation Support Package for the Advanced Low Altitude Radar Model (ALARM) (U)

Issued: July 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Allred, B.; Ellis, S.; Goodman, T.; Wixson, Ed

Abstract:

This document summarizes the results of detailed verification and validation (V&V) efforts applied to ALARM so that users or evaluators can establish the degree to which the intended software design is implemented in code and the degree to which model functionality replicates performance of radar systems under test conditions. Verification reports for functional elements (FEs) of the model are presented in section 2 along with discrepancies noted by independent agents. Validation results for FEs (in section 3) provide comparisons between lower level functions (e.g., antenna patterns, filters) and measurements made on actual systems in a controlled environment. Top, or model level results (in section 4) examine comparisons between model predictions and observed phenomena during operational or integrated testing of radar systems. Where possible, sources of discrepancy are identified and model deficiencies are documented. The degree to which the V&V information provided addresses requirements for intended use of the model will either facilitate its accreditation or identify further efforts needed to accredit it for use in a particular application.

Report No.: JTCG/AS-95-M-007

Report Classification: UNCLASSIFIED

Title: Phase II Accreditation Support Package for the Advanced Low Altitude Radar Model (ALARM) (U)

Issued: June 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Allred, B.; Ellis, S.; Goodman, T.; Wixson, Ed

Abstract:

This document is designed to provide inputs to logical verification and face validation activities performed by subject matter experts (SMEs) or prospective users with a need to establish confidence that ALARM inputs and outputs are reasonable valid representations of real world conditions and outcomes. Logical verification, which ensures that basic equations, algorithms, and design of the software are reasonable and correct, and which identifies assumptions and limitations inherent in the implementation is supported by the Conceptual Model Specification (CMS) that comprises section 2. Face validation, which consists of input data verification and validation (V&V), comparison of model outputs with intelligence data and known or best estimates, and an analysis of model behavior is supported by sensitivity analysis results that are presented in section 3. Information provided should allow a panel of SMEs or knowledgeable users to identify specific functions that require further examination or V&V to properly address requirements for intended applications as well as those functions that behave as expected and contain a sufficient level of detail to capture and simulate the phenomena of interest. The degree to which the software design and sensitivity information provided satisfies requirements for intended use of the model should serve to facilitate its accreditation as well as scope further V&V efforts that may be deemed necessary.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-006

Report Classification:
UNCLASSIFIED

Title: Phase I Accreditation Support Package for the Advanced Low Altitude Radar Model (ALARM) (U)

Issued: November 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
Muessig, P. R.; Ellis, S.; Landis, D.; Lapman, G

Abstract:

This document is designed to provide potential users with a characterization of the current state of ALARM with respect to criteria related to its general acceptability for use. Information collected during execution of Phase I accreditation support activities by an array of contractors is presented in sections that address the following: 1) configuration management (CM) policies, procedures, guidelines, and support functions along with a description of the current version and its development history; 2) a summary of assumptions and limitations inherent in the model design or implementation and a listing of known errors that might impact intended usage; 3) a review of the verification and validation (V&V) efforts applied to the model and a history of its use in study or analysis projects; 4) and assessment of documentation quality with emphasis on requirements for V&V that might be required; and 5) an assessment of software quality with respect to accepted standards and practices that could mitigate risks associated with intended or required modification or development efforts. The degree to which the information provided meets requirements for intended use of the model serves to facilitate further consideration or rejection of it as a potential candidate for accreditation.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-005

Report Classification:
UNCLASSIFIED

Title: Configuration Management Requirements Study

Issued: May 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Booz·Allen & Hamilton, Inc.
4141 Colonel Glenn Highway, Suite 131
Dayton, OH 45431

Author(s):
SURVIAC

Abstract:

The objective of the CM requirements study was to develop generic CM recommendations that will maintain the verification and validation status of models and simulations (M&S) assessed by the SMART project, and that will become a model for CM procedures for all SURVIAC M&S. A generic CM plan for SURVIAC M&S was developed, along with an implementation plan for the ESAMS model as a test case.

SURVIAC already acts as the focal point for model distribution and has excellent working relationships with the model managers. SURVIAC's role may be expanded to include maintaining the VV&A status of each model, providing visibility into the CM process and the rapid distribution of recommended model updates. The model user's role would also be modified by a new Model Site Agreement. This agreement would discourage model users from independently distributing model code and documentation and it would enforce the reporting of model modifications to the model developer.

The proposed CM procedures are not intended to disrupt or replace the CM systems already in use by model managers and users, but rather they are intended to augment and improve the procedures already in place.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-004

Report Classification:
UNCLASSIFIED

Title: An Accreditation Support Framework for DoD Models and Simulations

Issued: January 1995 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China lake, CA 93555-6001

Author(s):
SMART Project Office

Abstract:

This document describes an incremental model and simulation (M&S) accreditation support process developed under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project. The SMART Project was commissioned by the Office of the Secretary of Defense (OSD) in FY92 to: (1) develop a process for improving the credibility of M&S used to support acquisition decisions for airborne weapon systems; (2) test the proposed process on a set of existing M&S widely used in the Department of Defense (DoD); and (3) transition the process and support infrastructure to DoD organizations for expansion of the methodology to other types of M&S. The accreditation support process developed to fulfill these objectives includes verification, validaton and configuration mangement (VV&CM) activities, and it is divided into three sequential phases, each of which produces a set of accreditation support products at successively greater levels of detail. These products (called Accreditation Support Packages, or ASP's) provide a standard way to report VV&CM results, and they summarize the essential information required to make accreditation decisions as defined by a survey of M&S users and policy makers who are actually involved in making those decisions. The three phases of VV&CM activity that comprises the accrreditation process are:

- Phase I - Model Characterization
- Phase II - Expert Review
- Phase III - Detailed Verification and Validation

Report No.:
JTCG/AS-95-M-003

Report Classification:
UNCLASSIFIED

Title: Document Description for SMART Accreditation Support PackagesAn Accreditation Support Framework for DoD Models and Simulations

Issued: January 1995 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China lake, CA 93555-6001

Author(s):
SMART Project Office

Abstract:

The purpose of this document is to introduce the reader to the purpose, format and content of the Accreditation Support Packages (ASPs) produced by the Susceptibility Model Assessment and Range Test (SMART) Project. The SMART Project was commissioned in FY92 to develop, test, establish and transition to DoD a credibility assessment process for the susceptibility functions of mature aircraft survivability models and simulations (M&S), M&S that were (and are) being used to support major system acquisition and testing decisions across the services. Since its inception, SMART has integrated the key elements of M&S credibility (verification, validation and configuration management) into a process whose outputs support accreditation decisions directly. This document describes these accreditation support products in detail, and embeds them within the context of accreditation as defined by existent and emerging service policies procedures and guidelines.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-95-M-002
ASC/XREWA-TR-95-1

Report Classification:
UNCLASSIFIED

Title: AA-10 Warhead Threat Performance Model (U)

Issued: April 1995 FINAL (Dec 93 - Sept 94)

Sponsor:
Aeronautical Systems Center (ASC/XREWA)
Eglin AFB, FL 32542-5499

Performing Organization:
ASI Systems International
838 N. Eglin Parkway, Suite 421
Fort Walton Beach, FL 32547-2592

Author(s):
Lillard E. Gilbert

Abstract:

(U) This report documents the results from the AA-10 Missile Warhead Threat Characterization Program. The program includes the warhead design information, test, test data analysis and development of the fragment threat performance data array. this report provides fragment, weight, shape, material, velocity and spacial dispersion information in a simple data array that defines the AA-10 warhead capability to generate an antiaircraft threat.

Report No.:
JTCG/AS-95-M-001

Report Classification:
UNCLASSIFIED

Title: Operator's Guide for DREAM Directed Radio Frequency Energy Assessment Model - Version 0

Issued: August1996 Final, April 1993—April 1995

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S.Army Research Laboratory
2800 Powder Mill Road
Adelphi, MD 20783-1197

Author(s):
John T. Tatum (Army Research Laboratory), Karen R. McLaughlin, Robert E. O'Connor, and Anthony N. Valle (SPARTA, Inc.)

Abstract:

This report constitutes both the user's and analyst's guides for the computer code DREAM (Directed Radio frequency Energy Assessment Model), DREAM is a Microsoft Windows application that is used to perform first-order assessments of system vulnerability to RF Energy. DREAM runs on IBM compatible computers to provide a friendly, graphics- oriented user interface and numerous built-in models for the effective coupling area of RF ports of entry and the failure distributions of typical electronics piece-part components. The output of DREAM is the probability of failure of a target system as a function of the incident RF power density and the target range. This report discusses how to use DREAM and the analytical models used to perform the failure probability calculations.

Report No.: GTRI A-9300-100

Report Classification: UNCLASSIFIED

Title: Single-Engine vs Dual-Engine Benefit Assessment Study for the Joint Advanced Strike Technology (JAST) Program

Issued: March 1995 Final 9/15/94 - 9/14/95

Sponsor:
Avionics Directorate, WL/AAWA-1
Wright Laboratory
WPAFB, OH 45433-7607

Performing Organization:
Georgia Institute of Technology
Georgia Tech Research Institute
GTRI/AERO
Atlanta, GA 30332-0844

Author(s):
Dimitri N. Marvis, Robert J. Engler, William A. Bell, et al (See Georgia Tech Team, Introduction, Section 1.3)

Abstract:

This final report is submitted at completion of the requirements of Contract No. F33615-92-C-1009, Task Order Assignment No. XI-14. It documents design analysis efforts performed by the Georgia Tech evaluation team for the Joint Advanced Strike Technology (JAST) Program Office. The report provides a comprehensive benefit assessment of single- versus dual-engine aircraft designs to substantiate the JAST strategy of investigating and demonstrating advanced aircraft design concepts. It is a detailed written version of the formal briefing given by the Georgia Tech evluation team to the JAST Program Director on 15 December 1994. It thus provides documentation on the methodology and data employed for the assessment study, as well as results, conclusions, recommendations, and the required parametric sensitivity matrices.

Report No.: NAWCWPNS TM 7859

Report Classification: UNCLASSIFIED

Title: F/A-18E/F Engine Nacelle Gas Generator Fire Extinguishing Tests

Issued: March 1995 Final

Sponsor:
NAVAIR

Performing Organization:
Naval Air Warfare Center Weapons Division
Code 418300D
China Lake, CA 93555

Author(s):
Leo Budd, Code 418300D

Abstract:

(U) This report documents the full-scale testing of gas generator fire extinguishers in a simulated F/A-18E/F engine nacelle. The work was performed to evaluate the feasibility of gas generator fire suppression as a replacement for the HALON 1301 extinguishing agent currently in use. Results of ballistic testing are also included in the report.

JTCG/AS BIBLIOGRAPHY

Report No.:
ARL-TR-738

Report Classification:
UNCLASSIFIED

Title: A Means for Incorporating Time-Dependent Phenomena in Existing Vulnerability Analysis Methods

Issued: April 1995 Final, July 1993-December 1993

Sponsor:
U.S. Army Research Laboratory
Aberdeen Proving Ground, MD 21005-5068

Performing Organization:
U.S. Army Research Laboratory
Attn: AMSRL-SL-BA
Aberdeen Proving Ground, MD 21005-5068

Author(s):
Phillip J. Hanes

Abstract:

There are many phenomena addressed by the vulnerability analysis community which are, in truth, time dependent. However, due to computational constraints, whether actual or historical, most such phenomena are treated in a manner that ignores or, at best, crudely approximates this time dependency. This report describes a method which could allow such dependencies to be added to existing vulnerability analysis software in a more physically realistic manner. It also describes a possible implementation of these ideas within a vulnerability analysis code.

Report No.:
JTCG/AS-94-V-002
NAWCWPNS TP 8203

Report Classification:
UNCLASSIFIED

Title: Steady-Flow Fuel Ingestion Tolerance Predictions for New Turbofan Engines

Issued: October 1994 (Est) Final

Sponsor:
NAWCWPNS
Survivability and Lethality Division
China Lake, CA

Performing Organization:
ASI Systems International
825 N. Downs Street
Ridgecrest, CA 93555

Author(s):
Gary Burgner

Abstract:

This monograph is published under the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) Project VP-2-01, "Fuel Ingestion Tolerance Specification." This project has as its objective the development of specifications and related test techniques by which engines can be qualified to demonstrate adequate tolerance of inlet fuel ingestion. It will also develop technology to rapidly detect imminent fuel ingestion and mitigate its effects, and disseminate this technology to the engine industry.

This report was reviewed for technical accuracy by Lester W. Throndson and John W. Holtrop. Work continues in the fuel ingestion field, and the contents of this report are subject to revision.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-94-V-001
NAWCWPNS TP8201

Report Classification:
UNCLASSIFIED

Title: Engine Assessment of Methods to Detect Inlet Fuel Ingestion and Mitigate Its

Issued: August 1994 Interim

Sponsor:
NAWCWPNS
Survivability and Lethality Division
China Lake, CA

Performing Organization:
ASI Systems International
825 N. Downs Street
Ridgecrest, CA 93555

Author(s):
Gary Burgner

Abstract:

(U) The failure of jet engines as a result of fuel ingestion accounts for a substantial fraction of all combat aircraft losses. This report describes engine tests of concepts and hardware developed to detect imminent engine fuel ingestion and mitigate its effects. The successful approaches identified in these tests, in addition to reducing the aircraft's fuel ingestion vulnerability, have helped define approaches and test procedures that would be used to verify compliance with fuel ingestion tolerance specification for new engines.

Report No.:
JTCG/AS-94-S-004

Report Classification:
UNCLASSIFIED

Title: Low Cost Advanced RWR Techniques for High Accuracy DF Systems, Phase 2 Final Technical Report

Issued: 9 January 1995 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Night Vision and Electronics Sensors Directorate
AMSEL-RD-NV-SE-TD
Ft. Monmouth, NJ 07703-5206

Author(s):
A. B. Evans, O. A. Fahrenfeld, M. A. Nash - AEL Industries, Inc.
Lansdale, PA 19446

Abstract:

This report describes the development, integration and test of a AN/APR-39A(V)1 equipment modified with dual polarized tilt faced antennas to implement a low cost DF improvement, and demonstration of the additional improvement achievable through combined amplitude & phase DF measurement. The first phase of this project, covered the development of tilt faced antennas and Neural Network algorithms for RWR system beamforming in the presence of multipath and extraneous signals. the phase I results were published in "Low Cost Advanced RWR Techniques for High Accuracy DF Systems, Phase I Final Technical Report"; dated August 1992.

The phase two consisted of two tasks: (1) the AN/APR-39A(V)1 RWR Appliqué, using dual circular polarized tilt faced antennas; and (2) a Laboratory Demonstration of the Amplitude/Phase Appliqué effort similar to that being implemented under the ATRJ full scale development program.

The results of the test show that a 2:1 improvement in monopulse amplitude DF performance is realizable by implementing the interlaced 8 beam antenna set (two quadrant sets) and implementing coarse frequency correction factors for beamwidth and squint variations. Further, amplitude accuracy improvement can be augmented with single baseline phase measurement to achieve DF accuracies on the order of 2 degrees RMS.

Report No.:
JTCG/AS-94-S-003
WL-TR-94-1099

Report Classification:
SECRET/NOFORN/WNINTEL

Title: Air-to-Air Anti-Radiation Missile Analysis and Modeling (U)

Issued: February 1994 Interim Dec 1992 - Dec 1993

Sponsor:
Avionics Directorate
Wright Laboratory
Air Force Materiel Command
WPAFB OH 45433-6543

Performing Organization:
Georgia Tech Research Institute
Georgia Institute of Technology
Atlanta, GA 30332-0800

Author(s):
Brian H. Mayhew, David G. Erickson

Abstract:

(U) This study addressed the update of the TRAP/SPAM air-to-air ARM missile engagement simulation and the evaluation of selected countermeasure techniques with and without missile approach warning (MAW). The updates addressed changes to the missile seeker model and the replacement of TRAP version 3.0 with version 3.1A. The updated simulation provides the capability to evaluate electronic countermeasures against the current air-to-air ARM threat as defined by the National Air Intelligence Center (NAIC). A MAW model was included in the simulation to initiate selected countermeasures. The simulation was tested and selected countermeasures were evaluated. The results showed that for some engagements, the target aircraft is very vulnerable without warning. With warning, several techniques show the ability to significantly reduce lethality.

Report No.:
JTCG/AS-94-S-001
PYU 1187

Report Classification:
SECRET

Title: Countermeasure Munitions for Low and Slow Aircraft (U)

Issued: March 1994 Final

Sponsor:
ARDEC, U. S. Army Armament
SMCAR-AEE-O (R. Ritchie)
Picatinny Arsenal, NJ 07806-5000

Performing Organization:
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025

Author(s):
Donald J. Eckstrom

Abstract:

(U) Two tasks were accomplished.
Task 1 (IR) — This task investigated a wide range of infrared flare compositions with the objective of maximizing the two-color intensity ratio while simultaneously maximizing the absolute Band 4 intensity when tested in a 75 knot windstream. Although development efforts were centered on the use of energetic reactants to improve the performance of two-color flares, it was found that the detrimental effects of most additives, which usually were manifested as an increase in burn time, generally outweighed their benefits.

Task 2 (UV) — The approach to the development of UV countermeasure munitions was to identify compounds with strong ultraviolet absorption and to develop techniques for dispersing these materials into large clouds representative of the shape and UV contrast of low and slow aircraft. A substantial data base of candidate materials was developed, and characterized. Several candidate propellants were identified that might be useful for dispersing the absorbing material, including measurements of their exothermic heat release and gas generation rates. This level of accomplishment is very good for the first develoment effort of a completely new technology. We have established a strong base for continued development of UV countermeasure munitions.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-94-M-008
ASC/XREWS-TR-94-2

Report Classification:
UNCLASSIFIED

Title: PIXPL3.0 User's Manual

Issued: March 1994 Final

Sponsor:
U. S. Army Research Laboratory, (AMSRL-SL-BA)
and
U. S. Air Force Aeronautical Systems Center
(ASC/XREWS)

Performing Organization:
ASI Systems International
838 N. Eglin Parkway, Suite 421
Fort Walton Beach, FL 32547-2592

Author(s):
Edward D. Aitken and Susan Long Jones

Abstract:
PIXPL3.0 is a version of PIXPL specifically tailored to perform interactively on a 32-bit Personal Computer and work stations while retaining its compatibility with the CRAY Y-MP and VAX computers. When operating in the PC or work station environment, plot routines are written for a printer having Adobe PostScript® lanquage installed.

Report No.:
JTCG/AS-94-M-007
ASC/XREWS-TR-94-1

Report Classification:
UNCLASSIFIED

Title: CONVERT 3.0 User's Manual

Issued: March 1994 Final

Sponsor:
U. S. Army Research Laboratory, Surv./Lethal.
Analysis Directorate and
U. S. Air Force Aeronautical Systems Center
(ASC/XREWS)

Performing Organization:
ASI Systems International
838 N. Eglin Parkway, Suite 421
Fort Walton Beach, FL 32547-2592

Author(s):
Susan Long Jones and Edward D. Aitken

Abstract:
The original CONVERT computer program is a modification of the RAWGEN computer program. The program has been maintained and updated to keep pace with the different platforms that have been introduced at Eglin and to the market in general. It has been adapted for the CRAY Y-MP 8/2128, a series of VAX computers, and subsequently modified and renamed CONVERT3.0 to operate on Personal Computers (PCs) and work stations.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-94-M-005
ASC/XREWA-TR-94-1

Report Classification:
SECRET NOFORN WINTEL

Title: HAVE FACTOR Warhead Threat Performance Model (U)

Issued: APRIL1994 Final

Sponsor:
Aeronautical Systems Center (ASC/XREW)
Eglin Air Force Base. FL 32542-5499

Performing Organization:
ASI Systems International
838 N Eglin Parkway, Suite 421
Fort Walton Beach, FL 32547-2592

Author(s):
Lillard E. Gilbert, (Lillard Research, Inc.)

Abstract:

(U) This report documents the results from the HAVE FACTOR Missile Warhead Threat Characterization Program. The program includes the warhead design information, test, test data analysis and development of the fragment threat performance data array. This report provides fragment weight, shape, material, velocity and spacial dispersion information in a simple data array that defines the HAVE FACTOR warhead capability to generate an antiaircraft threat.

Report No.:
JTCG/AS-94-M-003

Report Classification:
UNCLASSIFIED

Title: RADGUNS Antiaircraft Artillery Simulation Volume 3. Methodology and Design Manual – Version 1.9

Issued: 20 APRIL 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
US Army Foreign Science and Technology Center
Research and Analysis Directorate, Air Combat Division
(IAFSTC-RAC)
220 Seventh St., NE, Charlottesville, VA 222901-5396

Author(s):
Dwight FitzSimons, Dr. Robert Ramey, Susan Olson, Bill Holet, Charlotte Blair, Cheryl Knecht, Major Steve Satchwell, Captain Arnond Bustle, Steve Swier, Doug Bower, Traci Humes

Abstract:

Methodology and design manual for RADGUNS. Contains descriptions of the methodologies used in the various RADGUNS weapon models and the design of the models.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-94-M-002

Report Classification:
SECRET NOFORN

Title: RADGUNS Antiaircraft Artillery Simulation Volume 2. Supplement to User Manual (U) – Version 1.9

Issued: 20 April 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
US Army Foreign Science and Technology Center
Research and Analysis Directorate, Air combat Division
(IAFSTC-RAC)
220 Seventh St., NE, Charlottesville, VA 22901-5396

Author(s):
Dwight FitzSimons, Susan Olson, Major Steve Satchwell, Steve Swier, Doug Bower

Abstract:

(U) Supplementary data for RADGUNS User Manual (Volume 1). Contains classified data on weapon systems, aircraft, and jammers needed by the RADGUNS user.

Report No.:
JTCG/AS-94-M-001

Report Classification:
UNCLASSIFIED

Title: RADGUNS Antiaircraft Artillery Simulation Volume I. User Manual – Version 1.9

Issued: 20 April 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
US Army Foreign Science and Technology Center
Research and Analysis Directorate, Air combat Division
(IAFSTC-RAC)
220 Seventh St., NE, Charlottesville, VA 22901-5396

Author(s):
Dwight FitzSimons, Dr. Robert Ramey, Susan Olson, Bill Holet, charlotte Blair, Cheryl Knecht, Major Steve Satchwell, Captain Arnold Bustle, Steve Swier, Doug Bower

Abstract:

User manual for users of the RADGUNS simulation. Contains detailed instructions on the execution of the simulation and its use in gun effectiveness/aircraft survivability analysis.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-94-D-002
LMI-JL301RD1

Report Classification:
UNCLASSIFIED

Title: Revision 1 — Aircraft Battle Damage Repair (BDR) Analysis Methodology Development Requirements

Issued: 1 November 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Logistics Management Institute
2000 Corporate Ridge
McClean, VA 22102-7805

Author(s):
Bruce J. Kaplan, D. Jerry Wallick

Abstract:

The JTCG/AS has been asked by the Office of the Secretary of Defense (OSD) to develop and implement a DoD accepted analysis methodology to address BDR aspects of aircraft system design, development, and acquisition. A BDR analysis methodology workshop was conducted to investigate feasible extensions of existing survivability and logistics support analysis methods to include BDR. No methodology obstacles were identified which would preclude such extensions. Industry and government organizations were visited and solicited for specific details on existing methodology limitations that must be addressed to incorporate appropriate BDR considerations. This report summarizes findings from these visits and interviews and documents a recommended roadmap with near-, mid-, and long-term tasks and projects for developing the required BDR analysis capability.

Report No.:
SURVIAC TR-94-002

Report Classification:
SECRET

Title: (U) Desert Storm Aircraft Vulnerability

Issued: January 1994 Final February 1993 - January 1994

Sponsor:
ASC/XRESV
Wright-Patterson Air Force Base, OH

Performing Organization:
Survivability/Vulnerability Information Analysis Center
WL/FIVS/SURVIAC
2130 8th Street Suite 1
Wright-Patterson AFB, OH 45433-7209

Author(s):
Ralph E. Kanko

Abstract:

(U) This report examines the direct enemy hit incidents experienced in Desert Strom. Probabilities of hit and kill, hits versus days of war, and threat type are all presented. Desert Storm values are compared to previous predictions in the Close air Support Study and to vulnerability values from previous conflicts.

JTCG/AS BIBLIOGRAPHY

Report No.:
BLDR-R-001-94-03

Report Classification:
UNCLASSIFIED

Title: Laser Threat Model Version 4.1 Task Summary and Verification Analysis Report

Issued: June 1994 Final March 1993 - March 1994

Sponsor:
USAF Phillips Laboratory Advanced Weapons Directorate (PL/WST), Kirtland AFB, NM

Performing Organization:
Ball Aerospace
Systems Engineering Operations
10 Long Peak Drive
Broomfield, CO 80021

Author(s):
R.C. Bennett, J.S. Davis, R.M. Marshall, R.K. Munzer, A.R. Peil, K.S. Schlatter

Abstract:

The United States Air Force (PL/WE, AFOTEC/OA, and FASTC/TA) and the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) have, under previous efforts, sponsored the development of a High Power Microwave (HPM) Weapon Engagement Model. This weapon model was developed by Ball Systems Engineering Division (BSED), and was integrated into and tested within the baseline version of BSED's Laser Threat Model (LTM 3.0), and constitutes a new LTM baseline (LTM 4.0). LTM 4.0 provides a simulation with the capability to represent conventional (missile/gun), laser, and HPM weapon performance and effects on air and ground targets. It has been subjected to preliminary verification and validation during previous tasks. Under this effort, sponsored jointly by the JTCG/AS and PL/WS, additional upgrades and enhancements to the capabilities of LTM were implemented, and verification analyses were conducted in the ongoing evolution of the LTM and verification of its fidelity and utility.

In addition to implementation and verification of the upgrades, segments of the HPM weapon model were subjected to verification analyses against independent sources. These include atmospheric RF transmission, antenna models, and the combination of these two segments in calculating power densities propagated to targets. Where possible, independent, community accepted standards were used for comparison to LTM results. In other cases, detailed calculations and comparisons were performed to verify the correctness of the HPM specific portions of the LTM results. The LTM results were also compared to results from a comparable threat engagement, model in order to evaluate the relative accuracy of the two models in estimating HPM power densities delivered to targets in realistic engagements.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-V-001
NAWCAD-93061-60

Report Classification:
UNCLASSIFIED

Title: Advanced Hydraufluidic Technology Demonstration Applied to F/A-18 Hornet Aircraft

Issued: December 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NAWCAD-Warminster, HR Textron, Inc. and McDonnell Douglas Aerospace

Author(s):
David Keyser, Richard C. Deitrich

Abstract:

This report validates that hydraufluidic technology can control the flight of an advanced tactical aircraft for adequate range of backup flight profiles. Flying qualities analysis and piloted simulation have demonstrated that an F/A-18 Hornet aircraft configured with a hydraufluidic backup flight control system can achieve adequate flying qualities for carrier approach and landing, and aerial refueling. The system is a hydraulic oil-based fluidic system with temperature-compensated laminar angular rate sensors (providing stability augmentation), digital fly-by-wire or fluidic control of hydraulic actuators, and fluidic gain-changing between cruise and approach. A two-axis system, developed for flight demonstration, and a three-axis production-type system for an advanced tactical aircraft are presented. This report contains discussions of concept and hardware development, flying qualities analysis, piloted simulation and assessment, aircraft integration concepts and designs, and component and system test results. This technology can provide "get home" capability for tactical aircraft where digital flight control has failed or been disrupted. Also, fluidics can provide primary or backup flight control functions for trainer, helicopter, or transport aircraft where reliability, low maintenance requirements, and operation in a harsh environment are paramount.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-020

Report Classification:
UNCLASSIFIED

Title: Accreditation Requirements Study Report, Volumes I and II

Issued: February 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Computer Sciences Corporation
711 Daily Drive
Camirillo, CA 93010

Author(s):
Dennis R. Laack, Computer Sciences Corp.

Abstract:

The SMART Project is developing a novel and efficient process for the verification and validation (V&V) and configuration management (C/M) of aircraft susceptibility models. In order to make the products of the SMART project most beneficial to model users, a study of accreditation requirements was undertaken. The study addressed both the accreditation procedures and information requirements. This report summarizes the findings of the study regarding accreditation procedures.

The principal findings are that the emerging service policies impose a significant bureaucratic burden on persons involved in model accreditation. This burden will require extra time and money to accredit models. In contrast, current accreditation practices are relatively streamlined. However, they suffer from a lack on consistency from one organization to the next. Therefore, there is little confidence in the quality of many accreditation decisions. The report suggests an accreditation approach which maintains the efficiency of the current practices but requires development of guidelines for generating accreditation criteria and suggests establishment of an advisory body to assist in development of adequate criteria.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-017

Report Classification:
UNCLASSIFIED

Title: RADGUNS Sensitivity Analysis Report

Issued: June 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ASI Systems International
825 N. Downs
Ridgecrest, CA 93555

Author(s):
Humes, Tracy; O'Neal, Barry

Abstract:

This report describes the results of a sensitivity analysis conducted on the functional elements (FEs) of the Radar Directed Gun System Simulation (RADGUNS), conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project, whose goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulaitons (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

In the SMART validation process, a model is first broken down into a hierarchy of FEs, each of which contributes to the overall model result: prediction of radar detection performance in the case of ALARM. Part of the validation process includes a sensitivity analysis at the FE level, which tests each FE over and beyond its typical range of operation in order to uncover sensitivities to input data (and other) assumptions, and to help specify data collection requirements that would facilitate validation of the FE. This report describes the sensitivity analysis process and the results that were obtained for RADGUNS.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-015
ENTEK/ABQ-93-0104-TR

Report Classification:
UNCLASSIFIED

Title: VV&A/CM Status Report for ESAMS, ALARM, and RADGUNS (U)

Issued: April, 1993 · FINAL

Sponsor:

Performing Organization:
ENTEK, Inc.
2201 Buena Vista S.E., Suite 301
Albuquerque, NM 87106

Author(s):
Ellis, Dr. Sharon; Krenz, Timothy

Abstract:

This report describes the Verification, Validation, Accreditation and Configuration Management (VV&A/CM) status and activities discovered for the Enhanced Surface-to-Air Missile Simulation (ESAMS) Version 2.6.2, the Advanced Low Altitude Radar Model (ALARM) 1991 release, and the Radar Directed Gun System Simulation (RADGUNS) Version 1.7. The purpose of the document is to identify and summarize previous verification and validation activities, prior accreditations, and configuration management activities for each of these models. This establishes a baseline set of VV&A/CM information that can (and has been) used to tailor future V&V and CM activities for these models.

This effort was conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project, whose goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

As the SMART Project becomes cognizant of other V&V activities, and as it pursues its own V&V program, this document will be updated and revised to reflect such results, and VV&A/CM Status Reports for each individual model will be developed.

Report No.:
JTCG/AS-93-SM-014
JTCG/AS-92-SM-FEAR

Report Classification:
UNCLASSIFIED

Title: ALARM Functional Element Assessment Report (U)

Issued: March, 1993 FINAL

Sponsor:

Performing Organization:
SAIC
2301 Yale Blvd, SE, Suite E
Albuquerque, NM 87106

Author(s):
Goodman, Thomas; Landis, David; von Loh, John; Wixson, Edwin

Abstract:

This document summarizes the current status of validation efforts for the Advanced Low Altitude Radar Model (ALARM), conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project. SMART's goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

For this report, test data from a variety of sources were collected and compared to model predictions for the conditions of the test. The document describes the process used and the results of the comparisons in accordance with a standard reporting format developed by the SMART Project for this purpose. The report includes: 1) a description of each major functional element (FE) and how it is implemented in ALARM; 2) a sensitivity analysis plan, describing how each FE was tested over and beyond its range of operation to determine sensitivity to input data (and other) assumptions; 3) sensitivity analysis results; 4) a description of the data required to validate the FE, including required accuracies and sampling rates to ensure valid statistical comparisons with measured test data; 5) a description of the actual data collected; 6) an FE assessment plan, describing how the data were used to validate the FE, and; 7) FE assessment results and conclusions. These reports are updated regularly by the SMART Project as new test data become available.

Report No.:
JTCG/AS-93-SM-013
WL-TR-95-1055

Report Classification:
SECRET

Title: Helicopter Signature Prediction Model Validation (U)

Issued: November 1994 Interim 10/88 - 10/93

Sponsor:
Avionics Directorate
Wright Laboratory
Air Force Material Command
WPAFB, OH 45433-7409

Performing Organization:
Georgia Institute of Technology - GTRI
Electro-Optics, Environment and Materials Lab
Atlanta, GA 30332

Author(s):
Leanne Blakeslee, Leonard J. Rodriguez

Abstract:

(U) This report presents a comparison of measured infrared signature data within predictions from the TMC-2 model. The aircraft compared are the UH-60, CH-53, and AH-64. Various flight conditions are included. Discrepancies noted between prediction and measurements are noted and improvements in hardbody and plume model recommended. In general, the Apache (AH-64 and Blackhawk (UH-60 models compared better with the data then the CH-53.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-012

Report Classification:
UNCLASSIFIED

Title: Software User's Manual for the Advanced Low Altitude Radar Model (ALARM 3.0)

Issued: 16 August 93 Final

Sponsor:
Wright Laboratory
2241 Avionics Circle
WPAFB, OH 45433-7318

Performing Organization:
Science Applications International Corporation
1321 Research Park Drive
Dayton, OH 45432

Author(s):
Bruce Esken, Paul Hannen, Lawrence Janning, John Langenderfer

Abstract:

This document updates and supercedes JTCG/AS-92-SM-006, "Software User's Manual for ALARM91". It describes the input and output variables for the Advanced Low Altitude Radar Model (ALARM 3.0) program. This document contains the basic information needed to execute the ALARM 3.0 version of ALARM. Appendix B contains ALARM 3.0 output formats. Appendix C contains ALARM 3.0 sample inputs. Appendix D contains the corresponding output for the input files. The input files have been designed to test many aspects of ALARM 3.0 operation and may be used to verify proper operation of the model after installation. The output files contained in Appendix D contain only the resultant contour plot or flight path output, not the full echo of the input data. The full output files are included with the released software. Appendix E contains sample ALARM 3.0 run preparation instructions. Appendix F contains information of the support programs: GENANT, which generates basic antenna patterns; GRAPHIT, which generates flight path data plots: PDMERG, which merges multiple binary plot data files, PREPGP and PREPXP, which generate contour plots; and DIMENS, which changes frequently used parameters. Appendix G contains a change/error notification form for ALARM 3.0 to be returned to WL/AAWA-1 if problems are foumd to ideltify or to identify suggested future modifications.

This document was generated by Science Applications International Corporation under contract number F33615-89-C-1067, for the Electronic Warfare Requirements and Effectiveness Branch, Electronic Warfare Division of the Avionics Directorate at the Wright Laboratory (WL), Wright-Patterson AFB, OH. Additional work performed under the same contract number was performed to update ALARM and its documentation. Much of the effort during this task was in direct support of the Electronic Combat Simulation Research Laboratory.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-011

Report Classification:
UNCLASSIFIED

Title: Software Programmers Manual for the Advanced Low ALtitude Radar Model (ALARM 3.0)

Issued: 16 August 93 Final

Sponsor:
Wright Laboratory
2241 Avionics Circle
WPAFB, OH 45433-7318

Performing Organization:
Science Applications International Corporation
1321 Research Park Drive
Dayton, OH 45432

Author(s):
Bruce Esken, Paul Hannen, Lawrence Janning, John Langenderfer

Abstract:

This document updates and supercedes JTCG/AS-92-SM-007, "Software Programmer's Manual for ALARM91". It describes ALARM 3.0 from the computer science perspective and is intended to be a guide to the structure and methodology of the model. First, this document identifies the software programming environment necessary for ALARM 3.0. This is followed by the programming information associated with the computer science implementation of ALARM .30. This information is organized in the same manner as the model's source code structure. Appendix A contains a flow tree of ALARM 3.0 and Appendix B contains a brief description of each module in the model. It is strongly suggested that the Operational Concepts Document/Analyst's Manual be read first to gain an understanding of ALARM 3.0 from an engineering perspective.

This document was generated by Science Applications International Corporation under contract number F33615-89-C-1067, for the Electronic Warfare Requirements and Effectiveness Branch, Electronic Warfare Division of the Avionics Directorate at the Wright Laboratory (WL), Wright-Patterson AFB, OH. Additional work performed under the same contract number was performed to update ALARM and its documentation. Much of the effort during this task was in direct support of the Electronic Combat Simulation Research Laboratory.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-010

Report Classification:
UNCLASSIFIED

Title: Operational Concepts Document (Analyst's Manual) for the Advanced Low Altitude Radar Model (ALARM 3.0)

Issued: August 1993 Final

Sponsor:
Wright Laboratory
2241 Avionics Circle
WPAFB, OH 45433-7318

Performing Organization:
Science Applications International Corporation
1321 Research Park Drive
Dayton, OH 45432

Author(s):
Bruce Esken, Paul Hannen, Lawrence Janning, John Langenderfer

Abstract:

This document updates and supercedes JTCG/AS-92-SM-008, "Analysts Manual for ALARM91". It is an Operational Concepts Document (Analyst's Manual) which describes the engineering implementation of the Advanced Low Altitude Radar Model (ALARM 3.0) program. It describes the engineering implementation of ALARM 3.0, addressing both pulsed, moving target indication (MTI), and pulse doppler radars. The engineering implementation of both external and internal signals are discussed. External signals are those associated with the target body, target rotor blade, jammer, and clutter. Internal signals are those associated with the system noise and signal-to-interference ratio (S/I). The engineering implementation of all signal processing in ALARM 3.0 is discussed. This discussion covers doppler filters, MTI system, and the clutter response of the doppler filters and MTI system. The engineering implementaiton of all radar support functions is discussed. These support functions include: atmospheric attenuation, MTI system gating, pattern propagation factor, pulse blanking and eclipsing, radar antenna gain, detection theory, target radar cross section (RCS), and clutter reflectivity for land and sea. Finally, the engineering implementation of the geometry and terrain simulation support functions is discussed. Where appropriate, the OCD/AM relates the theory to the implementaiton of the methodology in ALARM 3.0.

This document was generated by Science Applications International Corporation under contract number F33615-89-C-1067, for the Electronic Warfare Requirements and Effectiveness Branch, Electronic Warfare Division of the Avionics Directorate at the Wright Laboratory (WL), Wright-Patterson AFB, OH. Additional work performed under the same contract number was performed to update ALARM and its documentation. Much of the effort during this task was in direct support of the Electronic Combat Simulation Research Laboratory.

Report No.:
JTCG/AS-93-SM-009
NSWCCD/RDTN-93/012

Report Classification:
SECRET

Title: The ESAMS 2.6 IRCM Flare Additions (U)

Issued: 30 September 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for users on the implementation of the MJU-7A/B, MJU-8A/B, MJU-10, MJU-22/B and M205 flares into ESAMS 2.6.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-009

Report Classification:
UNCLASSIFIED

Title: Software User's Manual - TRAP 3.1

Issued: March 1993 Final

Sponsor:
FASTC/TANW
4115 Hebble Creek Rd Suite 28
Wright Patterson AFB, OH 45433-5632

Performing Organization:
Battelle
505 King Ave
Columbus, OH 43201-2693

Author(s):
Timothy R. Byram, Donald G. Lewis, Douglas D. Perry, David J. Hoey (editor), Batelle, Columbus, OH

Abstract:

This report documents the Trajectory Analysis Program (TRAP) computer code, version 3.1, User's Manual, and supercedes TRAP version 3.0.

Report No.:
JTCG/AS-93-SM-008
NSWCCR/RDTN-93/009

Report Classification:
SECRET

Title: Gen-X Decoy Model in ESAMS 2.6 (U)

Issued: 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
John O. Bennett

Abstract:

(U) This report provides information for users, analysts, and programmers on the GEN-X expendable decoy model as integrated into ESAMS 2.6. This includes sample runs, discussion of input and output, discussion of model features, and a listing of all new and modified code necessary to implement the model in ESAMS 2.6. This document is not intended to stand alone. Rather, it must be used in conjunction with earlier documentation on the GEN-X model in ESAMS versions 1.5 and 1.7.

Report No.:
JTCG/AS-93-SM-006
NSWCCR/RDTN-93/006

Report Classification:
SECRET

Title: ESAMS 2.6 Analyst's and Programmer's Manual for the Projected Area Self Protection Chaff Model (U)

Issued: June 1993 DRAFT

Sponsor:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Performing Organization:
ARC Professional Services Group
Information Systems Division

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for programmers on the Crane Projected Area Chaff Cloud model as integrated into ESAMS 2.6. This report is an addendum to the ESAMS 1.7 version showing changes made in transfering the model from ESAMS 1.7 to ESAMS 2.6.

Report No.:
JTCG/AS-93-SM-005
NSWCCR/RDTN-93/005

Report Classification:
SECRET

Title: ESAMS 2.6 Users Manual for the Projected Area Self Protection Chaff Model (U)

Issued: June 1993 Final

Sponsor:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Performing Organization:
ARC Professional Services Group
Information Systems Division

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for users on the Crane Projected Area Chaff Cloud Model as integrated into ESAMS 2.6. This report is an addendum to the ESAMS 1.7 version showing changes made in transfering the model from ESAMS 1.7 to ESAMS 2.6.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-SM-004
NSWCCR/RDTN-93/004

Report Classification:
SECRET

Title: Generic Towed Decoy Model in ESAMS 2.6 (U)

Issued: 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
John O. Bennett

Abstract:

(U) This report provides information for users, analysts, and programmers on the generic towed decoy model as integrated into ESAMS 2.6. This includes sample runs, discussion of input and output, discussion of model features as well as limitations, discussion of methodology used in the model, and a listing of all new and modified code necessary to implement the model in ESAMS 2.6.

Report No.:
JTCG/AS-93-SM-001

Report Classification:
UNCLASSIFIED

Title: Software Requirements Specification for the IVIEW 2000 Project of the Combat Analysis Program Support (CAPS)

Issued: February 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NAIC/TAAE
WPAFB, OH 45433

Author(s):
T. Andrews

Abstract:

This document describes the software requirements specifications for the IVIEW 2000 aerial engagement reconstruction tool. This software tool is used to replay aerial engagement history data in a three-dimensional space. The visualization graphics include aircraft and missile icons, map data, and graphing windows of user defined parameters.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-S-008
NRL/MR-6552–92-7116

Report Classification:
SECRET

Title: Optical Overload in Focal Plane Arrays (U)

Issued: September 1992 Interim

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
Washington, DC 20375-5320

Author(s):
M. R. Kruer, J. T. Caulfield, C. J. Gridley, and C. A. Hoffman

Abstract:

(U) This paper presents the results of systematic measurements of degradation in IRFPAs due to optical overload. Results will be presented on three MWIR HgCdTe hybrid photovoltaic FPAs, two PtSi arrays, three CID InSb arrays, and one InSb hybrid photovoltaic FPA. Selected pixels of the FPAs were irradiated by single laser pulses having duration of 90 nanoseconds and also by continuous waveforms from a CW laser or an intense blackbody source.

(U) Physical mechanisms that lead to overload effects such as lag and crosstalk are discussed. The degradation that results from overload are analyzed from the standpoint of the various FPA components; the detector, input circuitry, and multiplexer. The results of the measurements are presented in terms that are believed important for sensor designers. for example, measured values are given for the flux levels which cause spurious responses in adjacent pixels. Other data is presented in terms of the amplitude of spurious signals as a function of the laser intensity in units of FPA saturation flux.

Report No.:
JTCG/AS-93-S-007
GTRI A-9070-000

Report Classification:
SECRET/NOFORN/WNINTEL

Title: EW Development Opportunity Analysis (U)

Issued: August 1993 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Georgia Tech Research Institute
Georgia Institute of Technology
Atlanta, GA 30332-0800

Author(s):
Multiple

Abstract:

(U) The project reported (three volumes) has been directed towards supporting the development of the next generation of countermeasure technology. Specifically, it addresses the impact of Low Observable technology on future EW R&D. The product of this effort is a guide to EW R&D investment planning. It consists of the consolidation of a wide variety of EW and Observable issues into a format for the use of EW Tech Base managers during the next decade. As such, the specific threat and CM items considered are treated in broadly bounded regimes to ensure their relevance in the years ahead as both the threats and the countermeasure technologies evolve.

(U) The effort reported is an analysis of countermeasure techniques in the context of low observable signatures. It is not an analysis of low observables, per se. The signatures of specific platforms are not addressed and there is no discussion of specific signature reduction techniques nor resultant platform characteristics.

Report No.:
JTCG/AS-93-S-006
WL-TR-93-1151

Report Classification:
SECRET

Title: Unique Multispectral Countermeasures Technology Tailored Flare (U)

Issued: October 1993 Final

Sponsor:
Wright Laboratory Avionics Directorate
(WL/AAWW-3)
2241 Avionics Circle Suite 16
WPAFB, OH 45433-7318

Performing Organization:
ARC Professional Services Group
Information Systems Division

Author(s):
William Pike (Lockheed Sanders), Chuck Files (Gen Sciences, Inc)

Abstract:

(U) Experimental infrared (IR) decoys with tailored spatial and spectral intensity distributions were developed and tested under high speed simulated windstream conditions (0.5 and 0.8 mach) at NAVSURFWARCENDIV Crane. Two high temperature fuel chemistries were tested. IR signatures of the decoys at nose aspects were significantly reduced from the signatures at tail aspects. A method to specify the spatial and spectral intensity distributions of the decoy is developed and presented along with the decoy design and development data.

Report No.:
JTCG/AS-93-S-005
WL-TR-93-1118

Report Classification:
SECRET

Title: Aerovortical Tailorable Decoy (U)

Issued: August 1993 Final 1 Sep 91 - 1 Sep 93

Sponsor:
Wright Laboratory Avionics Directorate
(WL/AAWW-3)
2241 Avionics Circle Suite 16
WPAFB, OH 45433-7318

Performing Organization:
Loral Electro-Optical Systems
300 N. Halstead Street
P.O. Box 7101
Pasadena, CA 91109

Author(s):
Stephen N. Schmotolocha, Robert J. Pederson

Abstract:

(U) New, tailorable decoy concepts were designed, developed, and tested in a simulated windstream environment. Testing showed that the aerovortical technology provided greater plume stabilization than similar conventional IR decoys with kinematic enhancements. This plume stabilization resulted in larger plume sizes which in turn created larger IR signatures for the decoy. The simulated windstream testing also gave indications of an improved color ratio for the decoy although there is some question as tot he test conditions during these measurements. Detailed radiometric, spectral, fluid mechanic and photographic measurements and analysis of this technology are presented in this report.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-S-004
WL-TR-93-1108

Report Classification:
UNCLASSIFIED

Title: Shielded Crucible Expendable

Issued: May 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Tracor/ San Ramon Operations
Bollinger Canyon Rd
San Ramon, CA 94583

Author(s):
Omar Fawal, Carl Dinerman, Larry Weinman, Robert Kellett, and Jerry McDougal

Abstract:

This report presents the details of research efforts to study the technical feasibility of a new decoy to protect Air Force tactical aircraft from infrared threats. Also, the test results are presented for a design concept which provides an infrared signature (IR spatial distribution) similar to that of an actual aircraft. The decoy heat source is a cylindrical "crucible" which is internally heated by a pyrotechnic mixture. The crucible radiant energy is subsequently redirected by a slotted shield "cone" to provide the desired spatial distribution.

Report No.:
JTCG/AS-93-S-003

Report Classification:
SECRET

Title: Reduced Bandwidth FLIR CCM (U)

Issued: June 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Hughes Aircraft Company
Electro-Optical Systems
2000 E. El Segundo Rd
El Segundo, CA 90245-0902

Author(s):
Craig Hoffman, NRL

Abstract:

(U) This is the final technical report for the Reduced Bandwidth FLIR program. The primary program goal was to demonstrate a method of hardening Long Wavelength Infrared sensors against high and low intensity frequency-agile CO_2 laser threats by truncating the sensor passband, thereby excluding all CO_2 spectral lasing lines. This report covers the performance period from May 1992 through April 1993. During this period, Hughes produced direct-injection readouts for LWIR Focal Plane Arrays (FPAs); characterized the electrical and optical performance of the FPAs; and executed comparative performance tests and countermeasure susceptibility evaluations of several FLIR passband configurations.

Report No.:
JTCG/AS-93-S-002
WL-TR-93-1117

Report Classification:
SECRET

Title: On-Board Receiver and Countermeasure Laser (ORACL) (U)

Issued: September 1993 Final

Sponsor:
Avionics Directorate
Wright Laboratory
WPAFB, OH 45433-7409

Performing Organization:
Laser Power Corporation
P.O. Box 2723
Del Mar, CA 92014

Author(s):
G. Flint, D. Hargis, D. Breckinridge, K. Rodriguez, D. Tanimoto

Abstract:
(U) In fulfillment of Contract F33615-90-C-1430, Laser Power Corporation has undertaken a program to develop and demonstrate a breadboard version of an On-board Receiver And Countermeasures Laser (ORACL) program. The program encompassed an ongoing review of potential laser weapon threats, the development of a breadboard system capable of countering those threats, together with extensive laboratory and field demonstrations concerning system effectiveness against a broad spectrum of anticipated threats. To develop a definition of laser countermeasure requirements for the near term, we have examined a wide range of weapon systems, both U.S. and foreign. These have been divided into two broad categories, namely those related to range finder/trackers and to semiactive laser missile systmes.

Report No.:
JTCG/AS-93-S-001

Report Classification:
SECRET/NOFORN

Title: Countermeasures Handbook for Aircraft Survivability (U)

Issued: August 1993 FINAL

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
2241 Avionics Circle
WPAFB, OH 45433-6543

Author(s):
Members of the Susceptibility Reduction Subgroup, JTCG/AS: Michael K. Murray, Editor; Assoc. Editors: QuesTech, Inc., Dayton, OH; MacAulay-Brown, Inc., Dayton, OH. Individual Chapter authors are credited at

Abstract:
(U) The purpose of this handbook is to provide a comprehensive, timely, and accurate publication on those aspects of EW that relate to aircraft survivability. For purposes of this handbook, EW includes radar and electro-optical warning, countermeasures equipment and techniques, expendable decoys such as chaff, flares, and electro-optical decoys, and electronic jammers and aircraft observable signature control techniques. The technical information is largely confined to EW, however there are some areas (i.e., medicine, space) that are included for completeness. This handbook is intended to be tutorial in nature for the use of Electonic Warfare planners, application designers, technicians, tacticians, and operators. The handbook is printed in three volumes. Volume I (Chapters 1 through 19) contains information on Introduction/Background/ Threat, Signature Technology, and Threat Detection/Avoidance. Volume II (Chapters 20 through 35) contains information on On-Board Self-Protection Countermeasures, Off-Board Self-Protection Countermeasures and Support Countermeasures. Volume III (Chapters 36 through 51) contains information of System Integration, Simulation/Test and Evaluation, and Tactics.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-93-A-002
BDM/MCL-93-16238-TR

Report Classification:
UNCLASSIFIED

Title: Human Injury Methodology

Issued: Jan '94 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeromedical Systems Division
Human Systems Program Office
8107 13th Street
Brooks Air Force Base, TX 78235-5218

Author(s):
Somers, C. E.; LeGrand, C. A.

Abstract:

The casualty prediction methodologies currently employed within the Department of Defense (DoD) have been developed as independent efforts and, thus, are often incompatible and inconsistent with each other. To improve the effectiveness of DoD casualty prediction efforts, the Crew Casualty Working Group (CCWG) of the JTCG/ME and JTCG/AS is developing a standard non-nuclear casualty prediction methodology called the Crew Casualty Assessment Process (CCAP). A major feature of the new methodology is that it provides a rigorous separation between the prediction of physical injury to the human and the prediction of the operational and medical consequences of the physical injuries. The portion of CCAP that predicts physical injury to personnel is called the Human Injury Methodology (HIM). The purpose of this development effort is to produce a top level specification for the HIM. The document is organized as follows: Section 1.0 is an introduction to the Human Injury Methodology final report. Section 2.0 of this document describes the research accomplished in this task. The two specifications which produced the HIM top-level specification and the standard injury specification, are included in Section 3.0 & 4.0 respectively. Section 5.0 presents conclusions and recommendations.

Report No.:
BRF/DL-2238-Y1

Report Classification:
UNCLASSIFIED

Title: High Temperature Superconducting Delay Lines & Filterbanks

Issued: April 1993 Final

Sponsor:
Wright Laboratory

Performing Organization:
Wright Laboratory
Avionics Directorate
WPAFB, OH 45433

Author(s):
Neal Fenzi

Abstract:

This report summarizes the technical progress from March 1992 to March 1993 on the High Temperature Superconducting Delay Lines and filterbanks program. The program has two main tasks: 1) to develop a direct radio frequency superconducting switched notch filterbank for use in the front end of wide-band microwave receiver systems to help reduce electromagnetic interface problems on a number of military weapon systems, and 2) to develop a superconducting microwave delay line that possesses good amplitude and phase characteristics. Both applications are intended to exploit the fact that superconducting materials can produce devices with much smaller size, wider bandwidth, lower loss, and higher quality factor than conventional microwave technology aproaches.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-VR-012
NAWCWPNS TP 8058

Report Classification:
UNCLASSIFIED

Title: History of Ballistic Testing on Large Scale All-Composite Aircraft Structure (U)

Issued: July 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Todd Anderson

Abstract:

This report identifies the ballistic testing of large scale all-composite aircraft structures that took place through 1990. Previously published test documentation is briefly reviewed, while unpublished analyses are dealt with more substantially. One important direction of the Joint Technical Coordinating Group for Aircraft Survivability (JTCG/AS) structures committee has been the development of computer code for predicting ballistic damage to composite structures, particularly hydraulic ram induced damage. This report will allow for a quick review of the types of data available for use in validating damage prediction codes.

Report No.:
JTCG/AS-92-VR-011
WL-TR-93-3033

Report Classification:
UNCLASSIFIED

Title: High Power Microwave Testing of a Digital Flight Control Computer

Issued: August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Jurt J. Ianacone, David Baughman, Gary Brock

Abstract:

This report gives results of testing a digital flight control computer in a high power microwave environment. Upset levels and types were recorded while the equipment was exposed to microwave pulses of varying width, intensity, and repetition rate. Results show that this computer configuration is hard to high power microwaves. Upsets were seen only above 10 W/cm^2. Simple shielding techniques can provide up to 10 db of protection at the frequencies tested. Upsets were chaotic, with the type of upset recorded as a function of the incident power level. This report describes the results of testing a digital flight control computer for microwave coupling. Coupling levels and equivalent antenna aperature area are given.

This is one of four reports covering the testing of a digital flight control computer for microwave vulnerability. They are: Low Level Coupling Assessments of a Digital Flight Control Computer (JTCG/AS-92-VR-008), Direct Microwave Injection of a Digital Flight Control Computer (JTCG/AS-92-VR-009), Pulse Injection of the Cross Channel Data Links of a Digital Flight Control Computer (JTCG/AS-92-VR-010), and High Power Microwave Testing of a Digital Flight Control Computer (JTCG/AS-92-VR-011).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-VR-010
WL-TR-93-3036

Report Classification:
UNCLASSIFIED

Title: Pulse Injection of the Cross Channel Data Links of a Digital Flight Control Computer

Issued: August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Jurt J. Ianacone, David Baughman, Gary Brock

Abstract:

Digital flight control computer cross channel data links were subject to pulses replicating demodulated high power microwave signals. The computer system failures, along with conclusions and recommendations, are included.

This is one of four reports covering the testing of a digital flight control computer for microwave vulnerability. They are: Low Level Coupling Assessments of a Digital Flight Control Computer (JTCG/AS-92-VR-008), Direct Microwave Injection of a Digital Flight Control Computer (JTCG/AS-92-VR-009), Pulse Injection of the Cross Channel Data Links of a Digital Flight Control Computer (JTCG/AS-92-VR-010), and High Power Microwave Testing of a Digital Flight Control Computer (JTCG/AS-92-VR-011).

Report No.:
JTCG/AS-92-VR-009
WL-TR-93-3034

Report Classification:
UNCLASSIFIED

Title: Direct Microwave Injection of a Digital Flight Control Computer

Issued: August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Proj Engineer is Bruce Clough and Wm Baron, WL/FIBC

Abstract:

Microwave energy was directly injected into various digital flight control computer circuits to determine upset levels. These levels were established and upsets sorted according to type. The data within was combined with low power coupling test data to predict high power microwave upset levels.

This is one of four reports covering the testing of a digital flight control computer for microwave vulnerability. They are: Low Level Coupling Assessments of a Digital Flight Control Computer (JTCG/AS-92-VR-008), Direct Microwave Injection of a Digital Flight Control Computer (JTCG/AS-92-VR-009), Pulse Injection of the Cross Channel Data Links of a Digital Flight Control Computer (JTCG/AS-92-VR-010), and High Power Microwave Testing of a Digital Flight Control Computer (JTCG/AS-92-VR-011).

Report No.:
JTCG/AS-92-VR-008
WL-TR-93-3033

Report Classification:
UNCLASSIFIED

Title: Low Level Microwave Coupling Assessments of a Digital Flight Control Computer

Issued: August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Jurt J. Ianacone, David Baughman, Gary Brock

Abstract:

This report describes the results of testing a digital flight control computer for microwave coupling. Coupling levels and equivalent antenna aperature area are given.

This is one of four reports covering the testing of a digital flight control computer for microwave vulnerability. They are: Low Level Coupling Assessments of a Digital Flight Control Computer (JTCG/AS-92-VR-008), Direct Microwave Injection of a Digital Flight Control Computer (JTCG/AS-92-VR-009), Pulse Injection of the Cross Channel Data Links of a Digital Flight Control Computer (JTCG/AS-92-VR-010), and High Power Microwave Testing of a Digital Flight Control Computer (JTCG/AS-92-VR-011).

Report No.:
JTCG/AS-92-VR-007
WL-TM-93-304

Report Classification:
UNCLASSIFIED

Title: Testing Environment for Establishing Vulnerability of Digital FCS to High Power Microwave Radiation

Issued: May 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Bruce Clough and Wm Baron, WL/FIBC

Abstract:

This Technical Memorandum presents a specific set of test recommendations for determining digital flight control system (DFCS) vulnerability to high power microwave (HPM) radiation. The test techniques and levels were determined through actual testing of a DFCS in an HPM environment, as well as other avionics systems similar in electronic construction. Current DFCS are complicated systems with significant automated capability. Any testing technique has to take into account system characteristics such as the built in tests and redundancy management software mechanized in these fault tolerant, flight critical systems. Examination of hardware alone will lead to erroneous predictions on system vulnerability. Prior HPM tests have been hampered by the lack of understanding system operation. Testing has to catch both digital upsets and analog upsets, a combination which could lead to several test specific software versions. The goal is to augment production tests to cover HPM signal characteristics, upsets, and point toward cures. The rational build up to HPM test recommendations in this paper will lead to a basic level of understanding the interactions between microwaves and DFCS.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-VR-006
MTL TR 92-64

Report Classification:
UNCLASSIFIED

Title: Design, Fabrication & Ballistic Testing of a Prototype Helicopter Modular Armor System

Issued: September 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Research Laboratory, Materials Directorate
Watertown, MA 02172-0001

Author(s):
John P. Bird, Earl E. Conabee, John H. Graves* and Albert A. Anctil*

Abstract:

A prototype system of aircraft modular armor designed to protect troops in the cargo bay of a next generation utility helicopter was fabricated and ballistically tested against armor piercing incendiary, ball, and high explosive incendiary projectiles. The modular armor system consisted of armor panels mounted on a composite airframe structure and a fuze shield to ensure premature detonation of high explosive threats. The response of the prototype modular armor system was determined for each threat. An assessment of the airframe section's ability to support both structural and flight loads was also made. The results of ballistic testing indicate that modular armor is a weight effective solution for defeat of armor piercing incendiary and high explosive incendiary projectiles at realistic stand off distances. A confidential addendum to this report has been printed under separate cover.

Report No.:
JTCG/AS-92-VR-004
WL-TR-92-3106

Report Classification:
UNCLASSIFIED

Title: Advanced Vehicle Management System (AVMS) Architecture Studies - Final Report for Period June 1990 - June 1992

Issued: October 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
WPAFB, OH 45433

Author(s):
Kenneth R. Gault, Carlos A. Bedoya, Chris A. Miller, John L. Mohr McDonnell
Douglas Corporation McDonnell Aircraft Company St. Louis, MO 63266-0516

Abstract:

This report describes the study results for the four major tasks of the Advanced Vehicle Management System (AVMS) Architecture Studies. The objective of the AVMS study is to identify the architectural concepts and the integrated development environment necessary for the next generation of vehicle management systems for advanced air vehicles. The first task of the program was to determine the AVMS requirements by performing a functional analysis of representative missions. AVMS requirements are derived for survivability, safety, redundancy, mean time between failure, computer resources, response time and probability of mission abort. The second major task was to define and evaluate potential AVMS architectures. A baseline and six candidate architectures are defined and evaluated in a comprehensive trade study. Two candidate architectures, one near-term and one post-1998, received high scores in the trade study. The third task was to define an integrated tool environment which could be used for the design, analysis, development, and verification of advanced VMS architectures. The fourth task was to quantify the benefits from the AVMS program, identify shortfalls needed for the integrated tool environment, processes, software, and architectures, and develop a roadmap to reduce the shortfalls.

Report No.:
JTCG/AS-92-VR-003
NAWCWPNS TP 8076

Report Classification:
CONFIDENTIAL

Title: Ballistic Tests of Structural Concepts to Mitigate Damage and Reduce Fuel Leakage from Aircraft Tank - Duct Walls (U)

Issued: June1994 Final

Sponsor:
NAWCWPNS
Survivability and Lethality Division
China Lake, CA

Performing Organization:
ASI Systems International
825 N. Downs Street
Ridgecrest, CA 93555

Author(s):
Gary Burgner

Abstract:

(U) The failure of jet engines as a result of fuel ingestion accounts for a substantial fraction of all combat aircraft losses. This report is a compilation of results of ballistic tests conducted on 24" x 24" panels embodying materials and structural concepts intended to mitigate damage to and reduce fuel leakage from aircraft inlet duct/fuel tank common walls. In addition to reducing the aircraft's fuel ingestion vulnerability, the successful approaches identified in these tests would be useful in reducing structural, drybay fire, and fuel depletion vulnerabilities. Over a three-year period, nearly 100 materials and structural concepts have been assessed. Panels have been supplied at no cost by contractors, in addition to being built in-house at NAWCWPNS's Weapons Survivability Laboratory (WSL).

Report No.:
JTCG/AS-92-VR-002
NAWCWPNS TP 8075

Report Classification:
CONFIDENTIAL

Title: Reducing Aircraft Vulnerability to Engine Inlet Fuel Ingestion (U)

Issued: June1994 Final

Sponsor:
NAWCWPNS
Survivability and Lethality Division
China Lake, CA

Performing Organization:
ASI Systems International
825 N. Downs Street
Ridgecrest, CA 93555

Author(s):
Gary Burgner

Abstract:

(U) This report is a compilation of recommendations to reduce the vulnerability of jet aircraft to inlet fuel ingestion. The failure of engines as a result of inlet fuel ingestion accounts for a substantial fraction of all combat aircraft losses. Both "quick-dump" and "steady-flow" ingestion are discussed.

(U) Much of the information presented here is based on testing of late model turbofans under the Joint Live Fire (JLF) program. Those tests were conducted at the Naval Air Warfare Center Weapons Division (NAWCWPNS) using many innovative techniques, instrumentation, and photography. Many parameters associated with quick-dump ingestion were quantified for the first time. This quantification, combined with analysis of engine reactions to controlled ingestions, provides vastly improved understanding of the failure mechanisms and damage potential of the fuel ingestion threat.

Report No.:
JTCG/AS-92-VR-001
NAWCWPNS TP 8074

Report Classification:
CONFIDENTIAL

Title: Aircraft Engine Inlet Fuel Ingestion: What We Know About This Vulnerability (U)

Issued: September 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Gary Burgner

Abstract:

(U) This report is a compilation of what is known about the inlet fuel ingestion threat by the survivability/vulnerability community. It also presents new models to predict engine reaction. Both "quick-dump" and "steady-flow" ingestion are discussed. Recent testing, combined with analysis of the engine's reaction to the controlled ingestions, provides a vastly improved understanding of the failure mechanisms and damage potential of the fuel ingestion threat. Many engine failures are probably attributed to engine hits when the cause was actually inlet fuel ingestion. The military aircraft industry is gradually becoming aware of the seriousness of inlet fuel ingestion and is producing designs in which common tank-duct walls are being eliminated or designed to reduce the potential for ingestion. The invention and assessment of such approaches was a principal activity of JTCG/AS Project VP-8-01. This report and others produced under VP-8-01 are intended to promulgate awareness of the problem and possible solutions to the industry.

Report No.:
JTCG/AS-92-SM-031
ASD-TR-91-5029

Report Classification:
SECRET

Title: Component Vulnerability (Pd/h) Workshop - Recommendations and Panel Summaries (U)

Issued: March 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
Wright Patterson AFB, OH

Author(s):
Cramer, Russell (Frontier Technology, Inc.); Bennett, Gerald (ASD/XRM)

Abstract:

(U) One of the steps in the vulnerability assessment process of aeronautical systems to non-nuclear weapons is the development of estimates of the probability of damage given a hit (Pd/h) for the critical components. Recent assessments and reviews of overall documentation and supporting b allistic test data showed that no well-docuemnted body of data existed for use in current and future vulnerability analyses.

(U) In order to evaluate and document the current state-of-the-art and needed improvements and supporting ballistic test programs, a Component Vulnerability (Pd/h) Workshop was defined and convened in March 1991. Panels, composed of DoD and contractor experts, examined the current capabilities, recommended Pd/h data for current DoD usage, and developed suggested improvements and extension programs. This report summarizes the Workshop and each of the Panel reports.

Report No.:
JTCG/AS-92-SM-030

Report Classification:
UNCLASSIFIED

Title: High Power Microwave (HPM) Vulnerability Assessment Guide

Issued: April 93 Final

Sponsor:
U.S. Army Research Laboratory (ARL)
2800 Powder Mill Road
Adelphi, MD 20783-1197

Performing Organization:
SPARTA, Inc.
4901 corporate Drive
Huntsville, AL 35805-6201

Author(s):
R. E. O'Connor, R.O. Haack, H.O. Everitt

Abstract:

High Power Radio Frequency Microwave (HPRF/M) radiation can cause adverse effects on the electronics of aeronautical systems. This guide has been developed to aid aeronautical survivability analysis in estimating the vulnerability of aircraft and missiles to HPM. The guide contains basic mathematical models for HPM coupling and component failure thresholds to aid the analyst in estimating both the aircraft failure level and the types of effects. Using this guide, the survivability analyst can make quick, initial estimates of the power density required to cause aircraft failure due to HPM induced interference/upset and/or damage to the aircraft's electronic system. Based on these required HPM power density levels, the safe keep-out range of an aircraft from a specific HPM emitter can be determined.

Report No.:
JTCG/AS-92-SM-029
NSWCCR/RDTN-92/0016

Report Classification:
SECRET

Title: The ESAMS 1.7 Programmer's Manual for the Projected Area Self Protection Chaff Model (U)

Issued: 26 August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for programmers on the projected area self protection chaff model in ESAMS 1.7. See also The ESAMS 1.7 Analysts Manual for the Projected area Self Protection Chaff Model NSWCCR/RDTN-92/0015 and The ESAMS 1.7 Users Manual for the Projected Area Self Protection Chaff Model NSWCCR/RDTN-92/0014.

Report No.:
JTCG/AS-92-SM-028
NSWCCR/RDTN-92/0015

Report Classification:
SECRET

Title: The ESAMS 1.7 Analyst Manual for the Projected Area Self Protection Chaff Model (U)

Issued: 26 August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center
300 Highway 361
Crane, IN 47522-5001

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for analysts on the projected area self protection chaff model in ESAMS 1.7. See also The ESAMS 1.7 Users Manual for the Projected Area Self Protection Chaff Model NSWCCR/RDTN-92/0014 and The ESAMS 1.7 Programmers Manual for the Projected area Self Protection Chaff Model NSWCCR/RDTN-92/0016

Report No.:
JTCG/AS-92-SM-027
NSWCCR/RDTN-92/0014

Report Classification:
SECRET

Title: The ESAMS 1.7 User's Manual for the Projected Area Self Protection Chaff Model (U)

Issued: 26 August 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center, Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
James T. Sweeten, Jr.

Abstract:

(U) This report provides information for users on the projected area self protection chaff model in ESAMS 1.7. See also The ESAMS 1.7 Analysts Manual for the Projected Area Self Protection Chaff Model NSWCCR/RDTN-92/0015 and The ESAMS 1.7 Programmers Manual for the Projected area Self Protection Chaff Model NSWCCR/RDTN-92/0016

Report No.:
JTCG/AS-92-SM-026
NSWCCR/RDTN-92/0013

Report Classification:
SECRET

Title: Generic Towed Decoy Model in ESAMS 1.7 (U)

Issued: May 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center Crane Division
300 Highway 361
Crane, IN 47522-5001

Author(s):
John O. Bennett, Charles Hantzis (Atlantic Research Corp.), Lyman Hitchcock (Editor)

Abstract:

(U) This report provides information for users, analysts, and programmers on the generic towed decoy model as integrated into ESAMS 1.7. This includes sample runs, discussion of input and output, discussion of model features as well as limitations, discussion of methodology used in the model, and a listing of all new and modified code necessary to implement the model in ESAMS 1.7. Volume I contains the user, analyst and programmer manuals. Volume 2 contains the code listing.

Report No.:
JTCG/AS-92-SM-025
ARL-CR-69

Report Classification:
UNCLASSIFIED

Title: A Guide to FASTGEN Target Geometric Modeling

Issued: October 1993 Final

Sponsor:
U. S. Army Research Laboratory
AMSRL-OP-CI-B
Aberdeen Proving Ground, MD 21005-5066

Performing Organization:
ASI Systems International
838 N. Elgin Pkwy, Suite 421
Fort Walton Beach, FL 32548

Author(s):
Edward D. Aitken, Susan L. Jones, and Allen W. Dean

Abstract:

Vulnerability analysis programs, such as COVART, require target description data of sufficient detail and completeness to represent the physical and geometric detail of the target model from any attack aspect. The FASTGEN 3 computer model is used to generate the target description by developing a listing of the physical dimensions of target components, component location, and air spaces encountered along parallel shotlines passing through the target from a specified attack direction.

A prerequisite to the execution of FASTGEN is the development of a geometric description of a target whose exterior and interior components surfaces are described using triangles, spheres, cones, cylinders, and rods. the objective of this manual is to provide a gujide to experienced and inexperienced model developers to assist them in developing geometric models using the CONVERT computer code to generate target description data in the FASTGEN fdormat. Specific model preparation procedures, recommended procedures, frequently encountered pitfalls and proven shortcut model preparation procedures are discussed. Emphasis is placed on the use of CONVERT constructs in model development.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-019
None

Report Classification:
UNCLASSIFIED

Title: Annotated Briefing for the SMART Project Proof of Concept (U)

Issued: July, 1992 FINAL

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center
Weapons Division, Code C21806
China Lake, CA 93555

Author(s):
Hall, David; Muessig, Dr. Paul

Abstract:

This annotated briefing is an Unclassified version of a Secret briefing delivered to the Susceptibility Model Assessment and Range Test (SMART) Project Senior Steering Group (SSG) on 16 July, 1992. SMART's goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation for use in support of system acquisition (and other) decisions across DoD and the Services. The current focus is on aircraft survivability M&S.

The briefing summarizes the results of a Proof of Concept for the SMART Project, wherein the actual implementation of essential project functions was presented, with examples of associated deliverables that would support M&S accreditation.

Report No.:
JTCG/AS-92-SM-018

Report Classification:
UNCLASSIFIED

Title: The Adequacy of Field Test Data to Support Model Validation

Issued: July 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Arrowhead Technologies, Inc.
1000 Nevada Highway, Suite #205
Boulder City, NV 89005

Author(s):
Simecka, Karl

Abstract:

This report focuses on one of the basic questions asked regarding the validation of aircraft survivability models and simulations: are field test data of sufficient accuracy to support comparisons with model outputs? This study was conducted to provide a quantitative answer to the question. The developers of the Enhanced Surface-to-Air Missile Simulation (ESAMS) and the Advanced Low Altitude Radar Model (ALARM) were asked to determine the accureacies and sampling rates they would desire for validation of their models. A limited set of this information was compared against field instrumentation capabilities found in the data base called Automated Range Resources Inventory Planning System (ARRIIPS), compiled by the Air Force Operational Test and Evaluation Center (AFOTEC). the report summarizes the comparison between range capabilities as specified in ARRIIPS and the data requirements specified by the model developers.

This effort was conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project, whose goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulaitons (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-016
None

Report Classification:
UNCLASSIFIED

Title: ALARM Sensitivity Analysis Report (U)

Issued: November 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
SAIC
2301 Yale Blvd, SE, Suite E
Albuquerque, NM 87106

Author(s):
Goodman, Thomas; Landis, David; von Loh, John; Wixson, Edwin

Abstract:

This report describes the results of a sensitivity analysis conducted on the functional elements (FEs) of the Advanced Low Altitude Radar Model (ALARM), conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project, whose goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulaitons (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

In the SMART validation process, a model is first broken down into a hierarchy of FEs, each of which contributes to the overall model result: prediction of radar detection performance in the case of ALARM. Part of the validation process includes a sensitivity analysis at the FE level, which tests each FE over and beyond its typical range of operation in order to uncover sensitivities to input data (and other) assumptions, and to help specify data collection requirements that would facilitate validation of the FE. This report describes the sensitivity analysis process and the results that were obtained for ALARM.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-015
ENTEK/ABQ-93-0104-TR

Report Classification:
UNCLASSIFIED

Title: VV&A/CM Status Report for ESAMS, ALARM, and RADGUNS

Issued: April 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ENTEK, INc.
2201 Buena Vista S.E., Suite 301
Albuquerque, NM 87106

Author(s):
Ellis, Dr. Sharon; Krenz, Timothy

Abstract:

This report describes the Verification, Validation, Accreditation and Configuration Management (VV&A/CM) status and activities discovered for the Enhanced Surface-to-Air Missile Simulation (ESAMS) Version 2.6.2, the Advanced Low Altitude Radar Model (ALARM) 1991 release, and the Radar Directed Gun System Simulation (RADGUNS) Version 1.7. The purpose of the document is to identify and summarize previous verification and validation activities, prior accreditations, and configuration management activities for each of these models. This establishes a baseline set of VV&A/CM information that can (and has been) used to tailor future V&V and CM activities for these models.

This effort was conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project, whose goal is to develop, test, establish and transition a verification, validation and configuration management process for mature modes and simulaitons (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

As the SMART Project becomes cognizant of other V&V activities, and as it pursues its own V&V program, this document will be updated and revised to reflect such results, and VV&A/CM Status Reports for each individual model will be developed.

Report No.:
JTCG/AS-92-SM-014
JTCG/AS-92-SM-FEAR

Report Classification:
UNCLASSIFIED

Title: ALARM Functional Element Assessment Report

Issued: March 1993 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
SAIC
2301 Yale Blvd, SE, Suite E
Albuquerque, NM 87106

Author(s):
Goodman, Thomas; Landis, David; von Loh, John; Wixson, Edwin

Abstract:

This document summarizes the current status of validation efforts for the Advanced Low Altitude Radar Model (ALARM), conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project. SMART's goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

For this report, test data from a variety of sources were collected and compared to model predictions for the conditions of the test. The document describes the process used and the results of the comparisons in accordance with a standard reporting format developed by the SMART Project for this purpose. The report includes: 1) a description of each major functional element (FE) and how it is implemented in ALARM; 2) a sessitivity analysis plan, describing how each FE was tested over and beyond its range of operation to determine sensitivity to input data (and other) assumptions; 3) sessitivity analysis results; 4) a description of the data required to validate the FE, including required accuracies and sampling rates to ensure valid statistical comparisons with measured test data; 5) a description of the actual data collected; 6) an FE assessment plan, describing how the data were used to validate the FE, and; 7) FE assessment results and conclusions. These reports are updated regularly by the SMART Project as new test data become available.

Report No.:
JTCG/AS-92-SM-013
BDM/A-92-1149-S

Report Classification:
SECRET/NOFORN/WNINTEL

Title: ESAMS Assessment Results in Support of the SMART Project Proof of Concept (U)

Issued: July 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
BDM International, Inc.
1801 Randolph Rd. SE
Albuquerque, NM 87106

Author(s):
Dr. Sam Baty

Abstract:

(U) This document reports the results of exercising and assessing two versions of the ESAMS model. One version is the Advanced ESAMS (2.6.2) which has been distributed to Beta sites. The other version is the experimental ESAMS (2.6.SMART) that is based on the latest available intelligence data. The changes to ESAMS 2.6.2 that is in the ESAMS 2.6.SMART configuration are delineated in Appendix A.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-012
BDM/A-92-1153-S

Report Classification:
SECRET/NOFORN/WNINTEL

Title: Functional Element Decomposition and Data Requirements Dictionary for the SMART Project (U)

Issued: July 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
BDM International, Inc.
1801 Randolph Rd. SE
Albuquerque, NM 87106

Author(s):
Dr. R. Sam Baty and Ms Vandi Williams (BDM International, Inc.) and Mr. Ed Wixson (The SURVICE Engineering Co.)

Abstract:

(U) This document provides the requirements for experimental data thought necessary to assess the ALARM91 and ESAMS 2.6.2 models. The document has been prepared following the SMART program concepts and procedures for model assessment. It consists of three components:

- Functional Template,
- Data Requirements Dictionary,
- Functional Element Descriptions.

Both the Missile Flyout and RF Sensor sections contain all three components.

This document is intended for those who will actually be testing the models; consequently, while not saturated with technical details, its contents should provide insight on how to test the model in question to achieve the most beneficial data.

Report No.:
JTCG/AS-92-SM-011
ENTEK/AS-92-0115-TR

Report Classification:
UNCLASSIFIED

Title: Software Verification Requirements Study for the SMART Project

Issued: June 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ENTEK, Inc.
2201 Buena Vista, S.E., Suite 301
Albuquerque, NM 87106

Author(s):
Ellis, Dr. Sharon; Krenz, Timothy

Abstract:

The purpose of this Software Verification Requirements Study (SVRS) is to define software verification requirements for mature M&S. The work was conducted under the auspices of the Susceptibility Model Assessment and Range Test (SMART) Project. SMART's goal is to develop, test establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S. The report reviews and summarizes MIL-STD, DoD-STD and service-specific guidelines for software verification and analyzes them for application to mature M&S (those developed before promulgation of the standards). The report concludes with recommendations as to a minimum set of documentation required to support the verification of mature M&S software. Specific models in the target group of M&S included the Enhanced Surface-to-Air Missile Simulation (ESAMS), the Advanced Low Altitude Radar Model (ALARM) and the Radar-Directed Gun System Simulation (RADGUNS).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-010
None

Report Classification:
UNCLASSIFIED

Title: T & E Assets Database Assessment for the SMART Project

Issued: December 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ASI Systems International
825 N. Downs
Ridegecrest, CA 93555

Author(s):
O'Neal, Barry W.

Abstract:

This document describes capabilities and features of database products and services that could support test planning and data collection efforts of the Susceptibility Model Assessment and Range Test (SMART) Project. SMART'S goal is to develop, test, establish and transition a verification, validation and configuration management process for mature models and simulations (M&S) that can be used to facilitate their accreditation in support of system acquisition (and other) decisions across the DoD and the Services. The current focus is on aircraft survivability M&S.

Examination of existing databases was aimed at the identification of specific test assets that might be employed in the service of model and simulation (M&S) validation, and the level of detail that could be ascertained regarding their data collection capabilities and/or limitations. Two databases were identified initially: the Test and Evaluation Long Range Investment Plant (TELRIP) package for the Navy Major Range and Test Facilities Base (MRTFB), and the DoD T&E Assets database, which is maintained on the TECNET system by the Naval Air Test Center (NATC). A third product, the Air Force Systems Command (AFSC) Program Manager's Guide and Directory to Test Centers of Expertise, was found on the TECNET and included due to the applicability to SMART project planning efforts.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-009

Report Classification:
UNCLASSIFIED

Title: Susceptibility Model Assessment and Range Test (SMART) Project Plan

Issued: 6/1/92 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Susceptibility Model Assessment and Range Test (SMART) Project
Naval Air Warfare Center, Weapons Division
China Lake, CA 93555-6001

Author(s):
SMART Project Office

Abstract:

Aircraft Survivability models and simulation (M/S) are widely used within the Department of Defense (DOD) throughout an airborne weapon system's life cycle. They are typically, although not exclusively, used: to predict system survivability during the acquisition decision process; in conjunctions with tests to evaluate system survivability during Development Testing (DT) and Operational Testing (OT); to develop and evaluate proposed tactics in realistic combat environments; and to assist in training pilots on the potential effects of threat systems used against them.

The use of M/S to support these and other applications is becoming more widespread as the difficulty and cost of testing against real or simulated threats increases. In addition, because of the increasing costs of systems development, more detailed and extensive analyses are required prior to initiating acquisition programs. As a result, M/S are being employed much earlier in development cycles, resulting in decisions having significant impact on system design.

Report No.:
JTCG/AS-92-SM-005
NSWCCR/RDTN-92/OOO1

Report Classification:
SECRET

Title: Users, Analyst & Programmers Manual for the Extension of the GEN-X Model ESAMS v1.5 - Part 1 (U)

Issued: January 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NSWC-Crane
Crane, IN 47522-5001

Author(s):
Sheila A. Markham

Abstract:

(U) This report documents the extension of the GEN-X model to an additional missile system in ESAMS 1.5

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-005
NSWCCR/RDTN-91/OOO1

Report Classification:
SECRET

Title: Users, Analyst & Programmers Manual for the Extension of the GEN-X Model ESAMS v1.5 - Part 2 (U)

Issued: March 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NSWC-Crane
Crane, IN 47522-5001

Author(s):
John O. Bennett, Sheila A. Markham

Abstract:

This report documents the extension of the GEN-X model to an additional missile system in ESAMS 1.5

Report No.:
JTCG/AS-92-SM-004
WL-TR-91-3017

Report Classification:
UNCLASSIFIED

Title: Reaction of AN/ALE-40 Flare Dispensers to Ballistic Impact

Issued: March 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
WL/FIVS
WPAFB, OH 45433

Author(s):
Lee, Lt Kurt; Bennett, Gerald

Abstract:

The JTCG/AS Flares Test Program, conducted at the Aircraft Survivability Research Facility (ASRF) at Wright-Patterson AFB, OH during August of 1991, was designed to investigate the reaction of the AN/ALE-40 flare dispenser to the impact of foreign threat munitions. Nine test shots, using an array of actual foreign munitions (7.62-mm Armor Piercing to 23-mm High Explosive), were taken on five AN/ALE-40 flare dispensers and four simulated dispensers fully loaded with a magazine of fifteen MJU-7A/B flares. the dispensers were contained inside of a test set-up that simulated the volume, configuration, and material that would be typical of an aircraft dry bay containing an AN/ALE-40 system. Temperature and pressure history inside of the test set-up was recorded to provide insight into possible damage from a impacted dispenser. The results of this program indicate a high probability of flare ignition on threat impact and a definite possibility for enhanced aircraft damage. Recommendations from the program include a careful consideration of flare dispenser location within aircraft and appropriate fire protection in dry bays where catastrophic damage from the impact of the flare dispenser is likely.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-SM-002
NWSC/CR/RDTN-316

Report Classification:
SECRET

Title: ECM Corrections in ESAMS v1.7 for SURVIAC Error Logs 044, 049, 058, 059, 061, 063, 064, and 0193 (U)

Issued: January 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NWSC Crane Division
Crane, IN 49522-5001

Author(s):
John O. Bennett

Abstract:

This report documents the evaluation of the subject electronic countermeasures (ECM) error logs and the implementation of the necessary corrections in the Enhanced Surface-to-Air Missile Simulation (ESAMS) version 1.7

Report No.:
JTCG/AS-92-SM-001
ASD-TR-91-5032

Report Classification:
UNCLASSIFIED

Title: A Summary of Aerospace Vehicle Computerized Geometric Descriptions for Vulnerability Analyses

Issued: May 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ASD/XRM

Author(s):
Crosthwaite, Kevin R. (Booz•Allen & Hamilton, Inc.), Bennett, Gerald B. (ASD/XRM)

Abstract:

This report represents the results of an update of a 1987 survey and summary of computerized geometric models of aeronautical systems being developed by the DoD for use in vulnerability analyses. These geometric representations are developed using the tri-Service documented MAGIC, SHOTGEN, FASTGEN3, GIFT, or SCAN computer programs. In addition, this edition also contains listings of aircraft analyzed using the JTCG/ME developed QRV computer program. A brief summary of each geometric model is presented and a DoD contact point for more information is identified. Models that have been placed in the Survivability/Vulnerability Information Analysis Center (SURVIAC) for distribution are also identified. The report is printed in a loose leaf format to permit future revisions by a page update procedure. A blank summary page is included in the report for use in submitting updates or additions to the summaries. This report replaces ASD-TR-87-5031. A complementary summary of computerized geometric models for ground targets has been generated by the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME). This report should be consulted for these types of targets.

Report No.:
JTCG/AS-92-D-005
LMI-JL201RD3

Report Classification:
UNCLASSIFIED

Title: Report of Joint Service Aircraft Battle Damage Repair (BDR) Analysis Methodology Workshop

Issued: September 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
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McClean, VA 22102-7805

Author(s):
D. Jerry Wallick, Bruce J. Kaplan

Abstract:

The first Joint Service Aircraft Battle Damage Repair (BDR) Analysis Methodology Workshop, held 21 – 23 July 1992, was attended by 49 invited speakers and participants. On the basis of the work done in separate sessions on Acquisitions Logistics and System Development/Design and in plenary discussions, it was concluded that, although significant work needs to be done, there are no known methodology obstacles that would preclude proceeding with the process of including BDR in weapon system development. Discussions at the workshop have initiated the definition of interfaces among the various disciplines and agreement on approaches to modify existing methods to account for BDR.

Report No.:
JTCG/AS-92-D-004
LMI-JL201RD1

Report Classification:
UNCLASSIFIED

Title: Battle Damage Repair Guidelines for the System Acquisition Process

Issued: November 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Logistics Management Institute
2000 Corporate Ridge
McClean, VA 22102-7805

Author(s):
D. Jerry Wallick, Bruce J. Kaplan

Abstract:

The overall objective of battle damage repair (BDR) is to return a large number of battle damaged systems to combat readiness quickly. History has shown that the ability to return damaged equipment to combat has been a critical and sometimes decisive factor in successful military campaigns. BDR is only achieved through conscious, thorough consideration of numerous weapon system characteristics throughout the system's acquisition life cycle. This document suggests guidelines for activities and documentation to ensure BDR is explicitly considered in weapon system design, development, test and evaluation, and logistics support.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-92-D-003
LMI-JL201RD2

Report Classification:
UNCLASSIFIED

Title: Research and Development Plan for Aircraft Battle Damage Repair

Issued: June 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Logistics Management Institute
2000 Corporate Ridge
McClean, VA 22102-7805

Author(s):
D. Jerry Wallick, Bruce J. Kaplan

Abstract:

The DoD Battle Damage Repair (BDR) Steering Group, established by the Office of the Under Secretary of Defense for Acquisition, recognized the need for and directed development of this "Research & Development Plan for Aircraft Battle Damage Repair" as the first step in establishing and funding a BDR R&D program. The Aircraft Battle Damage Repair (ABDR) Committee of the JTCG/AS was tasked by the Steering Group Chairman to:

- Assess overall ABDR R&D needs
- Identify and prioritize technology development requirements to meet these needs
- Determine required funding profiles and schedules to accomplish critical ABDR technology development.

This plan represents a one year effort of data gathering from industry and the services, coordination of BDR R&D needs, and documentation of the findings.

Report No.:
JTCG/AS-91-VR-003
NWC TP 7152

Report Classification:
UNCLASSIFIED

Title: Generic Fighter Wingbox Ballistic Tests

Issued: September 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Todd M. Anderson, Timothy A. Wise

Abstract:

This report documents the ballistic tests of two all-composite wingboxes designed for the same loads as a generic fighter aircraft. The AS4 wingbox is an AS4/3501-6 material system, while the IM7 wingbox is an IM7/8551-7A material system. Both wingboxes were constructed at McDonnell Douglas Aircraft Company, (MCAIR) St. Louis, MO., as an industry research and development project. The test objectives were to investigate the effects of 23mm high explosive incendiary (HEI) rounds on all-composite wings, including the effects of load and hydraulic ram, and to examine the practicality of doing aircraft battle damage repairs (ABDRs).

Report No.:
JTCG/AS-91-VR-002
NWC TP 7154, VOL II

Report Classification:
UNCLASSIFIED

Title: Evaluation of the Linear Fire Extinguisher (LFE) - Volume II: Water-Based Explosion Suppression Agents Ballistic Test Program

Issued: September 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
John F. Barnes and James R. Duzan

Abstract:

The Linear Fire Extinguisher (LFE) system, developed by Systron Donner, is designed to enhance aircraft combat survivability by providing a self-contained, self-activated, quick-response method of protection against projectile-induced fires and explosions. The primary objective of this test phase (Phase V) was to provide empirical data allowing the evaluation of the LFE system's ullage explosion suppression performance using water-based suppression agents. The secondary objective was to collect data that would expand on earlier explosion suppression tests conducted during Phases I, II, and III. During Phases I, II, and IV, halogenated compounds were used as the extinguishing agents. During Phase III, in addition to Halon 1301, water and monoammonium phosphate powder were also used as extinguishing agents. Phase V expanded on this database by evaluating the following nine agents: distilled water; water and calcium chloride; water and ethehylene glycol; water and ethyl alcohol; water and aqueous film-forming foam; water and Halon 1301; water, aqueous film-forming foam, and Halon 1301; propane; and monoammonium phosphate powder and Halon 1301. The agents were stored in the LFE tube using nitrogen and/or carbon dioxide for tube pressurization.

Report No.:
JTCG/AS-91-VR-001
SURVIAC-TR-89-024

Report Classification:
UNCLASSIFIED

Title: Penetration Characteristics of Advanced Engine Materials

Issued: September 1989 Final

Sponsor:
Ballistics Research Laboratory
Aberdeen PG, MD

Performing Organization:
The SURVICE Engineering Company
1003 Old Philadelphia Rd Ste 103
Aberdeen, MD 21001

Author(s):
J. W. Foulk, B. E. Wheeler

Abstract:

This report presents the final results of a JTCG/AS program to investigate ballistic penetration and damage characteristics of advanced materials used in past, present, and future military aircraft turbine engines. The initial program efforts involved reviewing engine component vulnerability, engine material requirements and trends, and existing engine test data. A detailed ballistic test program was then planned and conducted during March 1989 at the U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland. This testing consisted of Cal. 0.50 impacts against metal and composite materials being used or considered for use in fan and intake assemblies, compressor and turbine disks, and combustor casing applications.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-91-SR-001
WL-TR-91-1022

Report Classification:
UNCLASSIFIED

Title: EW Applications of Superconductivity

Issued: June 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
Avionics Directorate
WPAFB, OH 45433-7318

Author(s):
William F. H. Ring, Aly E. Fathy, Gerry B. Andeen, David M. Bubenick, Jeffery E. Casper, Jonathan B. Corey, Larry S. Gullman, M. Lattimer Wright

Abstract:
This report investigates applications of superconductivity for enhanced aircraft survivability. Multi-service applications were of primary interest. Performance improvements over conventional approaches and logistic issues were emphasized.

Report No.:
JTCG/AS-91-SM-011
NWSC/CR/RDTN-304

Report Classification:
UNCLASSIFIED

Title: Description of the Time/Range-to-Go Feature on ESAMS 1.7

Issued: July 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Weapons Support Center
Crane, IN 97522-5001

Author(s):
John Byerly, John O. Bennett

Abstract:
This document describes the addition of time-to-go and range-to-go options to ESAMS 1.7. These options allow the starting time for ECM to be based on time-to-go before missile impact or missile to target range.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-91-SM-010

Report Classification:
UNCLASSIFIED

Title: M-on-N Susceptibility Assessment Verification, Validation and Implementation (SAVVI) - Final Report

Issued: June 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Barry O'Neal, ASI Systems International, David H. Hall and Paul R. Muessig, NWC

Abstract:

Given a need for the improvement of aircraft susceptibility assessment models and methodology, an identification of methodology shortfalls and data sources to test and validate models was undertaken. Using existing computer simulations approved or under consideration by the JTCG/AS, a benchmark comparison with data from an M-on-N tactical training scenario was conducted. The evaluation compared the predicted versus actual numbers and types of encounters, as well as the predicted versus actual outcomes of those encounters. Limitations of the methodology that were applicable to the assessment process, as well as shortfalls in the collected training data, were noted during the analysis and were accounted for via assumptions in order to arrive at reasonable conclusions. The comparative results are presented in this report, and demonstrate that range data can be successfully applied to assess the credibility of both models and analytical methodology if proper care is taken in the analysis. In addition, the analysis can be used to identify potential problem areas for some simulations. The final benchmark statistics demonstrate a fair agreement between predictions from the JTCG/AS models and actual range observations, but they must be constrained by reasonable assumptions that cover current simulation and test range limitations.

Report No.:
JTCG/AS-91-SM-009
NWSC/CR/RDTN-300

Report Classification:
SECRET/NOFORN

Title: Transition of the GEN-X Model from ESAMS 1.5 to ESAMS 1.7 (U)

Issued: March 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Weapons Support Center
Crane, IN 47522-5001

Author(s):
John O. Bennett

Abstract:

(U) This document contains information of the transition of the GEN-X model from ESAMS 1.5 to 1.7. The test runs used in the User's Manual, which were run in ESAMS 1.5, have been run again in ESAMS 1.7. the output of these test runs is expressed in the same format as in the User's Manual for the purpose of comparison. This document concludes with a discussion of the modifications which were part of the transition.

Report No.:
JTCG/AS-91-SM-008

Report Classification:
SECRET

Title: ROCOCO COLUMN Warhead Threat Performance Model (U)

Issued: February 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
Eglin AFB, FL

Author(s):
Lillard Gilbert

Abstract:

(U) The ROCOCO COLUMN Warhead Threat characterization program was conducted specifically to provide fragment weight, shape, material, weight frequency, velocity decay, initial velocity and spatial dispersion information in a simple data array that defines the warhead capability to generate an antiaircraft threat. The missile warhead threat data array was developed for use in evaluating the vulnerability of combat aircraft and flight vehicle protection concepts. The information contained in this report was generated from the analysis of the ROCOCO COLUMN warhead test data.

Report No.:
JTCG/AS-91-SM-007
MSD/EN-TR-90-155

Report Classification:
CONFIDENTIAL

Title: ROCHELLE SALT Warhead Threat Performance Model (U)

Issued: February 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
Eglin AFB, FL

Author(s):
Lillard Gilbert

Abstract:

(U) This report documents the results from the ROCHELLE SALT Missile Warhead Threat Characterization Program. The program includes the warhead design information, test, test data analysis and development of the fragment threat performance data array, and equivalent yield blast table. This report provides fragment weight, shape, material, velocity and spacial dispersion information in a simple data array that defines the ROCHELLE SALT warhead capability to generate an antiaircraft threat.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-91-SM-006
MSD/EN-TR-90-156

Report Classification:
SECRET

Title: CEASAR TRUMPET Warhead Threat Performance Model (U)

Issued: February 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Louis Diaz, Aeronautical Systems Division
Eglin AFB, FL

Author(s):
Lillard Gilbert

Abstract:

(U) This report documents the results from the CEASAR TRUMPET Missile Warhead Threat Characterization Program. The program includes the warhead design information, test, test data analysis and development of the fragment threat performance data array, and equivalent yield blast table. This report provides fragment weight, shape, material, velocity and spacial dispersion information in a simple data array that defines the CEASAR TRUMPET warhead capability to generate an antiaircraft threat.

Report No.:
JTCG/AS-91-SM-005

Report Classification:
UNCLASSIFIED

Title: Comparison of Electronic Countermeasures Modeling Techniques Among JTCG/AS Computer Simulations

Issued: January 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Air Force Electronic Combat Office
WPAFB, OH 45433

Author(s):
Dennis L. Detamore, Booz, Allen & Hamilton, Inc.

Abstract:

The purpose of this report is to document the comparison of the Electronic Countermeasures (ECM) modeling in selected engagement level computer simulations. The comparison reviews both the RF sensor algorithms that are affected by ECM and the ECM capabilities of the selected simulations. The simulations selected for the comparison are the Air-to-Air System Performance Evaluation Model (AASPEM 3.3), Advanced Low Altitude Radar Model (ALARM 88), Enhanced Surface-to-Air Missile Simulation (ESAMS 2.5), Integrated Missile and Radar Simulation (IMARS), Radar-Directed Gun System Simulation (RADGUNS 1.4), TAC BRAWLER 5.0, and the Trajectory Analysis Program (TRAP 3.1).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-91-SM-004

Report Classification:
UNCLASSIFIED

Title: Comparison of RF Sensor Modeling Among JTCG/AS Survivability Simulations

Issued: January 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Air Force Electronic Combat Office
WPAFB, OH 45433

Author(s):
Dennis L. Detamore, Booz, Allen & Hamilton, Inc.

Abstract:

The selected simulations were compared to a set of standards generated for this evaluation. The standards were for sensor types, sensor subsystems, environmental factors, and sensor procedures. The sensor subsystems, environment factors, and sensor procedures were characterized using three levels of detail: analytic, dynamic, and emulative. The analytic level is a simple, mathematical representation. The dynamic level is a well defined functional representation. The emulative level is a precise, detailed representation.

Report No.:
JTCG/AS-91-SM-003

Report Classification:
UNCLASSIFIED

Title: Terms of Reference Handbook for the Modeling and Simulation of Aircraft Survivability

Issued: May 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Air Force Electronic Combat Office
WPAFB, OH 45433

Author(s):
Dennis L. Detamore, Booz, Allen & Hamilton, Inc.

Abstract:

This document establishes standardized definitions for nonnuclear aircraft survivability modeling and simulation terms. These standard terms are established so that communication problems that have confronted government and industry agencies involved in aircraft survivability analyses can be resolved and eliminated.

Report No.:
JTCG/AS-91-SM-002
SURVICE-TR-90-068

Report Classification:
UNCLASSIFIED

Title: Integration of Vulnerability Analysis Requirements into Aircraft JLF Test Plans

Issued: December 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Center
Wright-Patterson AFB, OH 45433

Author(s):
A. M. Pascal, W. S. Vikestad, J. W. Foulk, The SURVICE Engineering Co.
(Michael R. Weisenbach, ASC/XRM)

Abstract:

This report presents the results of an assessment of future aircraft Joint Live Fire (JLF) test programs to determine their applicability to the development of Probability-of-Kill-given-a-hit (Pk/h) values. Based on this review, a number of recommendations are provided for test modifications and additional supplemental tests which, if implemented, should improve the ability to support generalized Pk/h development and validation.

Report No.:
WL-TR-91-3025

Report Classification:
UNCLASSIFIED

Title: Self-Repairing Flight Control System Volume II: Fuselage and Wing Damage Analysis and Development of Control Reconfiguration Concepts

Issued: August 1991 Final

Sponsor:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Performing Organization:
McDonnell Aircraft Company

Author(s):
Hoy, Stephen E.; Havern, William J.; Triplett, William E.; Urnes, James M.

Abstract:

The aeroelastic effects of battle damage on an F-15 airplane is investigated. Fuselage damage is alleviated, if necessary, by application of a variable notch filter using reconfiguration techniques. Loss of wing span does not lower flutter speed, and some lift loss can be compensated for by the reconfiguration system. Holes in a wing can lower flutter speed depending on the nature of the holes. This report documents the analyses leading to these results.

Report No.: WL-TR-91-3025, Vol I Part II

Report Classification: UNCLASSIFIED

Title: Self-Repairing Flight Control System Volume I: Flight Test Evaluation on an F-15 Aircraft - Appendices

Issued: August 1991 Final

Sponsor:
Wright Laboratory

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Field, Neil (Ensco); Vancia, Jose (Ensco); Hoy, Stephen; Stifel, Mark (GE); Weiss, Jerald (Alpha Tech); Parkinson, Robert (GE)

Abstract:
The self-repairing flight control system technologies consist of real-time reconfiguration and flight control maintenance diagnostics. A "proof of concept" flight test/demonstration was accomplished on the F-15 Highly Integrated Digital Engine control (HIDEC) airplane at NASA Ames-Dryden, Edwards AFB, CA. This appendix contains detailed documentation of the development and adaptation of these technologies to the test airplane for this program.

Report No.: SURVICE-TR-91-013

Report Classification: UNCLASSIFIED

Title: Testing of Aircraft or Aircraft Surrogates with On-Board Munitions

Issued: August 1991 Final

Sponsor:
OUSD DDRE(T&E)/LFT

Performing Organization:
The SURVICE Engineering Company
1003 Old Philadelphia Rd Ste 103
Aberdeen, MD 21001

Author(s):
Foulk, Jeffrey W., Levy, Ronald B., Vikestad, Walter S.

Abstract:
This study addresses the need for live fire ballistic testing of aircraft with munitions on board. Current law requires live fire testing of aircraft "configured for combat," which for some aircraft includes a variety of on-board munitions. However, the effect of munitions on aircraft vulnerability is not well quantified. The objectives of this project were to assess the potential benefits of live fire tests of aircraft or aircraft surrogates with live weapons on board, and to develop suggested notional testing schemes. Principal measures of effectiveness (MOE) for assessing aircraft vulnerability were identified. Available data on munitions contribution to aircraft vulnerability, including vulnerability/lethality testing, Southeast Asia combat data, and munitions sensitivity tests, were examined to determine the quantity and quality of the data, and identify gaps or inconsistencies. Vulnerability assessments were then made on three notional aircraft: an air-to-air fighter, an air-to-ground aircraft, and a rotary-wing aircraft. The changes in MOEs when munitions are added were quantified, as well as MOE sensitivity to munitions location, type of threat, and variations in postulated munitions probabilities of kill given a hit. Finally, suggestions were made on the conduct of live fire tests for aircraft with on-board munitions.

JTCG/AS BIBLIOGRAPHY

Report No.: **BRL-MR-3930**

Report Classification: **UNCLASSIFIED**

Title: A Proposed Method for Incorporating Ballistic Shock Effects in Vulnerability/Lethality Analysis

Issued: August 1991 Final

Sponsor:
Ballistic Research Laboratory

Performing Organization:
Army Research Laboratory APG, MD

Author(s):
James N. Walburt

Abstract:

This report describes a proposed method for modeling ballistic shock effects in vulnerability/lethality analyses. A novel approach is described which, under certain simplifying assumptions, can be implemented in a manner entirely compatible with the existing analytical environment.

Report No.: **DC-FR-8015.302-1**

Report Classification: **UNCLASSIFIED**

Title: Assessment of RF Effects on Systems (ARES): The Physical and Mathematical Foundations and User Manuals

Issued: August 1991 DRAFT

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Kaman Sciences

Author(s):
Yang, F. C.; Wong, F; Wong, I.; Lee, K.S.H.; Knight, D.; and Meinhart, R.

Abstract:

This report is the revision of DC-FR-8013.301-1 and DC-M-8013-301-3, which briefly describes the ARES (Assessment of RF Effects on Systems) computer code and the mathematical/ physical bases on which it is built. ARES is designed to be an end-to-end tool for assessment. It consists of a data preparation module, coupling topology and calculation modules, a fault tree module, an event tree module, an output module, and a probability-of-effect (Pe) module, including a fragility subroutine. It utilizes simple coupling rules for the calculation of both narrowband and broadband coupling responses to reduce computational time while maintaining numerical accuracy. The program is in modular format which allows for easy improvements and modifications in the future.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-90-T-004
NWC TP 7129

Report Classification:
UNCLASSIFIED

Title: The Effectiveness of Ullage Nitrogen-Inerting Systems Against 30-mm High-Explosive Incendiary Projectiles

Issued: May 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
J. Hardy Tyson and John F. Barnes

Abstract:

This report presents the data and results of tests conducted at the Naval Weapons Center to evaluate the use of nitrogen in aircraft fuel tanks to produce an inert atmosphere in the ullage. The objective of these tests was to define the limits of nitrogen effectiveness against explosive reactions in a large ullage space.

Tests were conducted at simulated low, high, and ambient altitudes. Testing included the evaluation of inert atmospheres containing 9, 12, 15, and 21% oxygen and the effects of these atmospheric conditions on reactions produced by a low-energy J-57 engine igniter and a comparatively high-energy 30-mm HEI projectile. All tests were conducted in a 30 cubic foot steel simulator. A total of 65 tests were performed, including both control and inert tests.

Report No.:
JTCG/AS-90-T-002
WL-TR-91-3008

Report Classification:
UNCLASSIFIED

Title: Fire-Explosion Protection Characterization and Optimization Phase I - Data Analysis and Documentation

Issued: May 1991 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
WRDC/FIVST
WPAFB, OH 45433

Author(s):
Dr. N. Albert Moussa and Mr. John J. Murphy, Jr.

Abstract:

The effort discussed in this report was an investigation into advanced ullage protection methods for an aircraft fuel tank. The approach used was to first review the raw test data of three separate fire/explosion suppressant test programs to determine their relation to each other and their applicability to the overall effort. Second, based on the data review, determine the performance of each agent used in the tests, the concentration levels used and whether the test setup and conduct of each separate test influenced the results. Third, to identify any data trends and/or data voids that could possibly be clarified with additional testing, and fourth, to document the results of the overall effort. The test programs reviewed and discussed in this report are the results of gun-fire tests conducted intermittently over a seven-year span at the Aircraft Survivability Research Facility (ASRF), Wright-Patterson Air Force Base, Ohio and are presented in three phases. The objective of Phase A was to investigate the effects of venting, threat type, striker plate material and tank wall simulator (TWS) size on the effectiveness of Halon 1301 against 0.50 cal. API and 23-mm HEI projectiles under the conditions of higher temperatures and pressures anticipated in the F-16 fuel tank. The objective of Phase C was to expand the Phase A work on venting with a broader range of conditions, including nitrogen and halon inerting and 23-mm and 30-mm HEI projectiles.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-90-T-001
WRDC-TR-90-3064

Report Classification:
UNCLASSIFIED

Title: Parker Reactive Explosion Suppression System (PRESS)

Issued: May 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
WRDC/FIVST
WPAFB, OH 45433

Author(s):
Ken Bragg

Abstract:

This report documents the work performed by the Parker Hannifin Corporation for the Flight Dynamics Lab and the JTCG/AS to optimize and perform proof-of-concept tests of the Parker Reactive Explosion Suppression System (PRESS). This innovative system is designed to be installed in aircraft fuel tanks and react to and suppress fuel tank explosions. It consists of an optical detector, transmission lines and a suppression tube(s) containing a water/brine solution. This system is designed to respond within a few milliseconds to engage the flame front and reduce pressures below damage causing levels. After detection, the transmission lines transmit a signal to the suppression tube, which initiates an exploding bridgewire circuit. This, in turn, initiates a detonating cord and propellant internal tube, creating a high pressure expulsion force to expel the adjacent bladder filled with water. The water exits through orifice holes, is transmitted through radial channels in the external nozzles and released as 5-micron-thick sheets. These sheets break up into 10-micron droplets which absorb thermal energy released by the explosion. This process occurs in its entirely within a few milliseconds. The proof-of-concept tests have shown the system to successfully reduce the over pressure created by a 23-mm HEI simulator detonated within an explosive propane air mixture in an experimental tank.

JTCG/AS BIBLIOGRAPHY

Report No.: **JTCG/AS-90-SM-004**

Report Classification: **SECRET**

Title: Directed Microwave Energy Weapon Simulation - DMEWS Version-AS - Analyst's Guide (U)

Issued: March 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Material Systems Analysis Activity
Aberdeen PG, MD

Author(s):
Mike Vincent (AMXSY-CS)

Abstract:

(U) The Directed Microwave Energy Weapon Simulation - Aircraft Survivability Version (DMEWS-AS) models a one-on-one engagement of a ground or air target by a directed microwave energy weapon (DMEW). The DMEW is modeled at a level of detail appropriate for a system effectiveness analysis. DMEWS-AS contains functional models representing the output of the DMEW microwave generator and the distribution of DMEW radiation by the DMEW antenna. No other DMEW functions are represented in DMEWS-AS. The engagement dynamics of the DMEWS-AS model are simulated by a modified version of the AMSAA INCURSION model. Several INCURSION routines have been modified to take into account the special characteristics of a microwave weapon. Other code modules determine the atmospheric attenuation and the probability of damage to susceptible components on the target. DMEWS-AS is an upgrade to DMEWS code originally developed by SPARTA, Inc. for U.S. AMSAA and updated in the area of target effects modeling for Harry Diamond Laboratories. The present upgrade was developed in accordance with the recommendations of the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS) and was also sponsored by the JTCG/AS.

Report No.: **JTCG/AS-90-SM-002**

Report Classification: **SECRET**

Title: Effects of Low Energy Lasers on Aircraft - Volume II. Database of LEL Effects on Aircraft Sensors (U)

Issued: February 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Material Systems Analysis Activity
Aberdeen PG, MD

Author(s):
Mike Vincent (AMXSY-CS)

Abstract:

(U) A continuing need exists to update the available susceptibility data base as derived from system test results and from computer model predictions based on device parameters and component test results. The susceptibility data base serves as a source of input data to analyze investigating the impact of LEL on aircraft operaitons. This document is Volume II of the Final Report of a task defined by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS). The assigned task was to survey the existing data on effects of low energy lasers on aircraft bio-optics effects and Volume I deals with the effects on EO sensors. Section 1 is the introduction; section 2 cites the types of lasers likely to be encountered in the threat; section 3 discusses types of equipment present in aircraft; section 4 discusses types and levels of damage; section 5 summarizes a number of reports reviewed in this field; section 6 attempts to summarize some of the data more compactly; and, section 7 presents some conclusions and final remarks.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-90-SM-001

Report Classification:
SECRET

Title: Effects of Low Energy Lasers on Aircraft - Volume I. Effects on Bio-Sensors (U)

Issued: February 1994 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Material Systems Analysis Activity
Aberdeen PG, MD

Author(s):
Mike Vincent (AMXSY-CS)

Abstract:

(U) Low energy laser (LEL) threats to aircraft sensors are emerging and the effect on aircraft survivability is a critical issue. Various test data have been developed in recent years, but there has been no coordinated effort to relate/correlate effects, thresholds, and test conditions. This lack of a comprehensive data base interferes with the important tsk of assessing threats s the efficient countermeasures (CMs) may be provided. It also precludes assessment of the capability of developing LEL weapon systems to counter threat aircraft. The purpose of this document is to provide information on aircraft bio-susceptibility to LELs. This is Volume I of a two volume set. Volume II provides information on aircraft EO susceptibility to LELs. It is intended that the information provided in these volumes be helpful to analysts and modelers of LEL effects on aircraft.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-90-CM-002
TR-90-1073

Report Classification:
SECRET

Title: LORALEI: The Advanced IR Decoy (U)

Issued: March 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Loral EOS and Aerojet Solid Propulsion Lab

Author(s):
S. N. Schmotolocha, R. Pederson, Ta-JIn Kuo, W. Donaldson and P. J. Trettel
of Loral EOS and D. Woodman and T. J. Rieger of Aerojet Solid Propulsion

Abstract:

(U) The objective of this program was to develop new off-board IR countermeasure technologies and an advanced decoy concept having kinematic and radiometric characteristics more closely resembling target aircraft. Furthermore, this program was to demonstrate the feasibility and practicality of this advanced decoy concept for protecting fixed and rotary wing aircraft and then to set bounds and limits for what can be ultimately achieved.

(U)Loralei is a miniaturized, aerodynamically maneuverable rocket-powered decoy that is spectrally matched to the target aircraft/helicopter, but with dominate intensity. It is not threat specific, but generic, and when coupled to a threat warning system, only one decoy per engagement is required.

(U)Loralei IR grains were tested at Mach 0.5 and 75 knots. Test results showed only a modest Band IV IR emission reduction at the Mach 0.5 conditions and minimal signature reduction at 75 knots flight speed. However, at higher airspeeds, Loralei's IR intensity increases, as demonstrated by additional tests conducted at NWSC/Crane (up to Mach 0.8) and Rockwell International wind tunnel (up to Mach 1/9 and 30,000 feet altitude). Thus, at supersonic speeds of about Mach 1.25, Loralei's power is fully restored to that at sea level static condition.
Based on test results, the Loralei decoy employing special molecular IRP solid fuel grain technology can effectively protect tactical fighters in all aspects, but the $\pm$ 20 degree tail cone against advanced IR threats. By integrating an intermetallic-reactive COMET technology into Loralei, full all-aspect protection can be achieved with spectral matching and can be packaged in current dispensers. Using a similar approach along with concept tailoring, both suppressed and unsuppressed helicopters can also be fully protected in all aspects. Based on recommended further improvements to the Loralei decoy, total emulation of fixed/rotary wing aircraft is possible.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-90-CM-001

Report Classification:
SECRET/NOFORN

Title: Surv. and Hardening of Tactical Aircraft in a Laser Incurred Threat Environment (SHOTLITE) Follow-on Activity (U)

Issued: August 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
Washington, D.C. 20375-5320

Author(s):
B. Meyers, R. K. Munzer

Abstract:

(U) This report covers the Survivability and Hardening of Tactical Aircraft in a Laser Incurred Threat Environment (SHOTLITE) Follow-on Activity. The performance period was April 1989 to June 1990. The data in this report focuses on the changes between this study and the original SHOTLITE study which was performed between September 1984 and May 1986. The original SHOTLITE program, Contract Number N00014-84-C-2353, was fully documented in JTCG/AS Report Number JTCG/AS-86-CM-002.

Report No.:
NWC TM 6785

Report Classification:
UNCLASSIFIED

Title: Reduction of Fuel Ingestion Vulnerability of the F/A-18 Aircraft, an Interim Report

Issued: September 1990 Final

Sponsor:
NAVAIR

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Gary Burgner and G. Philip Dixon, Code 3183, NWC

Abstract:

(U) This report documents the analysis and testing done to identify the most appropriate materials and installation locations required to protect the F/A-18 engine bay from fires resulting from both inlet fuel ingestion in combat and fires that have plaqued the aircraft in peacetime operations. Vulnerability tests of the F/A-18 conducted at the Naval Weapons Center, China Lake, CA in 1987 dramatically point out the potential for loss of the aircraft due to inlet fuel ingestion by only one engine. A sufficiently large ingestant flow will ignite in the afterburner and burn a large hole in the case. From this hole will issue a large and hot torch, which tends to blast through the airframe structure and beyond, and generally diffuse throughout the engine bay. The only solution known to be effective and immediately available is to protect the engine bay structure with an insulating or ablative thermal protection material.

Report No.: JLF-TR-88-3

Report Classification: UNCLASSIFIED

Title: Ballistic Tests Comparing the Flammabilities of MIL-H-5606 and MIL-H-83282 Hydraulic Fluids

Issued: December 1990 Final

Sponsor:
ODDDRE(T&E)/LFT

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Jibilian, Hagop Capt.; Benjamin, Richard Ph.D.

Abstract:

Ballistic testing of MIL-H-5606 and MIL-H-83282 hydraulic fluids was conducted in a 3000 psi hydraulic system housed in a simulated dry bay. Airflow was directed over the test article at either 475 knots to simulate flight, or 0 knots to simulate a parked aircraft. A Soviet 23-mm HEI-T projectile impacted the test article at approximately 2400 feet per second. A total of 128 shots was completed successfully. Airflow was observed to have a pronounced effect upon test outcomes. Under 0 knot conditions, MIL-H-5606 hydraulic fluid fires burned statistically longer and resulted in higher dry bay temperatures than MIL-H-83282. Under 475 knot airflow conditions, MIL-H-83282 fires burned statistically longer and resulted in statistically higher dry bay temperatures than MIL-H-5606.

Report No.: AFWAL-TR-86-3064, Volume III

Report Classification: UNCLASSIFIED

Title: Aircraft Battle Damage and Repair Volume III, A Presentation and Analysis of ABDR Data from Southeast Asia

Issued: August 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Vice, John M.; Lindenmuth, James R. ;Foulk, Jeffrey; Keller, Kris of The SURVICE Engineering Company

Abstract:

This report, Volume III of three volumes, provides a presentation and analysis of ABDR information for aircraft representatives of the types currently in the USAF inventory. Emphasis is on categorizing and presenting the data. Patterns and trends were developed relating damage and repair time with the extent of damage, type of threat, aircraft section/location, and aircraft type. The damage and repair data contained in this document are arranged by aircraft and threat. In some cases, threats are grouped together because there was insufficient information to identify the specific threat. Data for miscellaneous and unknown threat types are also presented. The miscellaneous category includes many sources of damage that do not fit the typical enemy threat types; however, because they occurred on the battlefield, they are pertinent to this study. The unknown cases constitute a relatively large block of data, and therefore provide additional and perhaps helpful repair information. The data have been summarized by area of damage, type of damage, internal components damaged, and repair times and techniques. The data for all incidents evaluated have been tabulated and are presented in Appendix A to this Volume.

JTCG/AS BIBLIOGRAPHY

Report No.:
MTL TR 90-11

Report Classification:
UNCLASSIFIED

Title: Development of Helicopter Modular Armor Systems and Installation Techniques

Issued: March 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Research Laboratory, Materials Directorate
Watertown, MA 02172-0001

Author(s):
R. J. Bristow and W. M. Herlin, and A. A. Anctil and J. H. Graves

Abstract:

The objective of this contract was to develop a representative modular armor system for use on a utility rotary wing aircraft to protect critical components such as troops against nonnuclear threats and AP and HE projectiles and to evaluate the effect of modular armor on aircraft survivability and performance. Modular armor was designed to be installed rapidly for hostile operations, replaced when battle damaged, and removed when not needed. A confidential addendum to this report is being printed under separate cover.

Report No.:
JTCG/AS-89-T-008
WRDC-TR-89-1144

Report Classification:
SECRET

Title: Alternate IR Decoy Flare (U)

Issued: November 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433-7318

Author(s):
C. E. Dinerman, D. G. Matuska, A. V. Fields - Tracor Aerospace, Expendables Technology Center

Abstract:

(U) The objective of this alternate IR Decoy program was to improve the long IR wavelength volumetric efficiency of shrouded flare configurations. To obtain the desired efficiency improvement, conventional pyrotechnic compositions were modified by the addition of various elements/compounds. In addition, various shroud lining materials were used for the purpose of adding combustion products, and insulating against heat loss.

(U) Pyrotechnic compositions and lining materials were selected from the results of a previous WRDC contract, Controlled Output Flare (F33615-84-C-1419). Phase I of this Alternate IR Decoy program involved the data review of previous efforts, and fabrication/testing of subscale flare hardware. Based upon the results of Phase I, Phase II involved further tests of full-scale flares using the Advanced Aerodynamic Flare as the baseline test configuration. Phase II testing was conducted by the Naval Weapons Support Center, Crane, IN using their windstream test facility.

(U) Phase II test data was not available at publication, however, will be made available as a separate Crane NSWC document at a later date.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-89-T-007
WRDC-TR-89-1127

Report Classification:
CONFIDENTIAL

Title: Alternate IR Decoy Development (U)

Issued: February 1990 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
D. J. Eckstrom, R. J. Schmitt, R. T. Rewick, B. Kingsley, G. R. Greenfield, T. J. Henry of SRI International

Abstract:
(U) The objective of this program is to improve the performance of infrared (IR) decoy flare by improving their spectral match to the aircraft while increasing absolute intensity in the long IR wavelength. This was done through the identification of new flare composition materials and a new flare configuration. These compositions and configurations were tested in a free-flight test facility based on an airgun launcher to show compliance with program goals. Based on test results, flare compositions were identified which offer the potential of achieving the objective stated above.

Report No.:
JTCG/AS-89-T-006

Report Classification:
UNCLASSIFIED

Title: Evaluation of the Linear Fire Extinguisher (LFE) - Volume I: Explosion Suppression and Dry Bay Fire Suppression Ballistic Test Program

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
John F. Barnes

Abstract:
The linear fire extinguisher (LFE) is a self-activated protection system designed to enhance aircraft combat survivability by providing protection against projectile-induced fires. A four-phase ballistic test series was conducted to evaluate the potential use of the LFE as an ullage explosion suppression system and expand on earlier dry bay fire suppression testing. A 10 cubic foot wing fuel tank simulator and a 30 cubic foot fuselage fuel tank simulator was used for explosion suppression testing. A 75 cubic foot dry bay simulator with up to 23% clutter installed was used for fire suppression testing. The primary threat used was the 30-mm high-explosive incendiary (HEI) projectile. However, limited testing with the .50-cal armor piercing, 12.7-mm armor piercing incendiary and 23-mm HEI was also conducted. A total of 133 tests were completed in this test series.

Report No.:
JTCG/AS-89-T-005
USAAVSCOM TR 89-D-16

Report Classification:
UNCLASSIFIED

Title: Aircraft Fuel System Fire and Explosion Suppression Design Guide

Issued: February 1990 Final

Sponsor:
U. S. Army Aviation Technology Directorate,
Ft. Eustis, VA

Performing Organization:
The SURVICE Engineering Company
1003 Old Philadelphia Rd Ste 103
Aberdeen, MD 21001

Author(s):
D. W. Mowrer, R. G. Bernier, W. Enoch, R. E. Lake, W. S. Vikestad

Abstract:

This study was sponsored by the Fuel Committee of the JTCG/AS to obtain an up-to-date review of, and guidance toward, usage of techniques or materials which would contribute to the elimination of, or reduction of, the fuel fire/explosion hazard resulting from ballistic impacts on aircraft. While fuel fire/explosion is a primary hazard, there are other considerations which require concurrent examination, as they can be just as responsible for aircraft loss. There have been similar guides of various types published in the past, but for the most part they were oriented to vulnerability analysts. This Design Guide is specifically oriented to the fuel system designer and as such, addresses the vulnerability aspect from the design viewpoint rather than the vulnerability analysis aspect.

Appendix C contains the Working Data Base in two parts for this effort.

Report No.:
JTCG/AS-89-T-004

Report Classification:
UNCLASSIFIED

Title: Critical Review of Ullage Code

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
N. A. Moussa

Abstract:

There have been a number of efforts in the past to generate a computer code to predict the vapor composition in an aircraft tank ullage. The most recent and wide-spread of such codes is called ULLAGE. The effort documented in this report provides a critical review of ULLAGE and a discussion of related studies. Major shortcomings and limitations of ULLAGE are identified and ways of improving them are illustrated. Recommendations are presented for developing a more accurate code, that would also apply over a broader range of conditions than ULLAGE.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-89-T-003
WRDC-TR-89-3066

Report Classification:
UNCLASSIFIED

Title: Advanced Wing Skin Material Evaluation

Issued: December 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Czarnecki, Gregory J.

Abstract:

When a composite wing's integral fuel tank is impacted by a high velocity projectile, hydrodynamic ram combines with projectile damage, forcing delaminated material into the airflow stream.

Sensitivity studies, conducted by the Flight Dynamics Laboratory at Wright Patterson Air Force Base, proved high-speed airflow (400 knots) over battle damaged composite surfaces significantly increases the level of initial damage. Protruding fibrous material is torn back toward the wing's trailing edge. Results of studies to reduce or eliminate the effects of high-speed airflow over battle damaged surfaces were reported in AFWAL-TR-87-3090 and AFWAL-TR-88-3086. In a second program to reduce the effects of airflow, the material's inherent fracture toughness was relied upon. Materials chosen were high-temperature toughened bismaleimide and thermoplastics. Composite panels were fabricated and ballistically tested with 23mm API projectiles. The material's relative merit with respect to battle damage resistance/ tolerance was evaluated.

Report No.:
JTCG/AS-89-T-002
AFWAL-89-3006

Report Classification:
UNCLASSIFIED

Title: A Survey of Analysis Techniques to Predict Residual Properties of Ballistically Damaged Aircraft Structures

Issued: April 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Moon, Young In and Falugi, Michael

Abstract:

The report documents a survey of analysis techniques to predict residual strength and fracture control capabilities for ballistically damaged aircraft structures. It provides recommended design guidelines that will enhance the survivability of composite structures used in future aircraft. Also included in this report are results of an extensive literature survey in areas of: ballistic threats, ballistic vulnerability of composite structures, and applications of analysis methods and recommendations for improving the Hydraulic Ram Structural Response (HRSR) Computer Code.

Report No.:
JTCG/AS-89-T-001
AFWAL-TR-89-3010

Report Classification:
UNCLASSIFIED

Title: Survivability of Integral Skin/Spar Design to Hydrodynamic Ram

Issued: March 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Oetting, David J.

Abstract:

A major concern in the development of composite integral fuel tanks is the lack of damage tolerance to hydrodynamic ram pressures resulting from ballistic damage. This program was established to investigate this phenomenon. The investigation of structural response of graphite/epoxy panels to hydrodynamic ram damage was accomplished in three parts. The first part dealt with the comparison of the damage response of aluminum panels to that of graphite/epoxy panels. The second part dealt exclusively with hydrodynamic ram technology as it applies to graphite/epoxy. The last part investigated the damage response of various skin/spar joints and their tolerance to hydrodynamic ram.

Report No.:
JTCG/AS-89-SM-002
TR-89-126.

Report Classification:
SECRET

Title: GRAY ROCK Warhead Threat Performance Model (U)

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
Eglin AFB, FL

Author(s):
Lillard E. Gilbert

Abstract:

(U) The GRAY ROCK Warhead Threat characterization program was conducted specifically to provide fragment weight, shape, material, weight frequency, velocity decay, initial velocity and spatial dispersion information in a simple data array that defines the warhead capability to generate an antiaircraft threat. The missile warhead threat data array was developed for use in evaluating the vulnerability of combat aircraft and flight vehicle protection concepts. The information contained in this report was generated from the analysis of the GRAY ROCK warhead test data.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-89-SM-001

Report Classification:
UNCLASSIFIED

Title: User's Manual for IRVING (Infrared/Visible Imaging - Numerically Generated)

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Dr. Thomas L. Barnett

Abstract:

The procedures for operating the series of programs comprising the IRVING (Infrared/Visible Imaging - Numerically Generated) target/background signature model are described in "IRVING Users' Manual." Input procedures are outlined for all the parameters involved in building the geometrical target model, building the background model, and describing the physical, radiative, and scenario properties. A companion document is "How IRVING Works."

Report No.:
JTCG/AS-89-CM-001
WRDC-TR-89-1126

Report Classification:
SECRET

Title: Alternate IR Decoy (U)

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Avionics Laboratory
WPAFB, OH 45433

Author(s):
Egbert, Paul, Kuppenheimer, J. D.

Abstract:

(U) Program goals included development of a visually covert flare, a spatial pattern to protect typical aircraft signatures, tailoring of flare spectral signature to defeat missile spectral discriminents, and tailoring of flare rise time to defeat missile temporal discriminents.

Report No.: AFWAL-TR-86-3064, Volume II

Report Classification: UNCLASSIFIED

Title: Aircraft Battle Damage and Repair Volume II, A Summary of ABDR Activity in Southeast Asia

Issued: June 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Vice, John M.; Lindenmuth, James R. ;Foulk, Jeffrey; Keller, Kris of The SURVICE Engineering Company

Abstract:
This report, Volume II of three volumes, describes the results of a comprehensive review and analysis of selected individual combat damage incident folders from the SURVIAC collection. This volume summarizes all pertinent damage and repair data and cites several combat damage, actual battle damage repair, and a description of the hours, skills, and parts needed.

Report No.: LMI-RE801R1

Report Classification: UNCLASSIFIED

Title: Battle Damage Repair of Tactical Weapons: An Assessment

Issued: August 1989 Final

Sponsor:
OUSD(TWP)

Performing Organization:
Logistics Management Institute
2000 Corporate Ridge
McClean, VA 22102-7805

Author(s):
Donald W. Srull, Edward D. Sims, Jr., Raymond A. Schaible

Abstract:
In this report we describe our findings and conclusions on the U.S. capability to repair battle damaged equipment in the Air Force, Navy and Army. We focus on the tactical fighter aircraft in the Air Force and Navy and ground combat vehicles and helicopters in the Army. Battle Damage Assessment and Repair (BDAR) programs in each Service for research and development, advanced technology, and logistics support are critically analyzed. Finally, we make recommendations for OSD on how the Defense Department's BDAR capability can be enhanced and how OSD can better manage the overall DoD BDAR program.

Report No.: WRDC-TR-89-3105

Report Classification: UNCLASSIFIED

Title: An Investigation of Missile Warhead Fragment Impacts into Aircraft Hydraulic Lines

Issued: July 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Research and Development Center
WPAFB, OH 45433

Author(s):
Capt. Hagop Jubilian, USAF

Abstract:

Survivability and lethality engineers have been investigating the effectiveness of air-to-air and surface-to-air missiles against enemy aircraft for years. A specific area of study has been the vulnerability of aircraft hydraulic systems to these threats. The test described in this report was designed to statistically compare the capability of different sized missile warhead fragments traveling at various velocities to induce fires in aircraft hydraulic systems. A simulated aircraft dry bay containing a single hydraulic line was impacted by a simulated missile warhead fragment, and the results analyzed. A test matrix of 120 shots was divided into 12 unique test conditions , thus creating a large quantity of tests with a limited number of variables. This produced data which could be statistically analyzed with a high degree of confidence. The 12 individual conditions were 2 different sized fragments, 30 and 110 grains, tested each at nominal impact velocities of 3000, 3600, 4200, 4800, 5400, and 6000 feet per second. MIL-H-83282 type hydraulic fluid was used. The results showed statistically significant differences between impact velocity and the probability of fire. In addition, other data showed the importance of proper test design to avoid obtaining inaccurate results which could be easily evaluated improperly. The results of this program will be used to increase both the missile lethality and hydraulic system vulnerability data bases.

Report No.: NWC TM 6517

Report Classification: UNCLASSIFIED

Title: Microstrip Patch Linear Traveling Wave Antenna Analysis/Synthesis

Issued: July 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Donald D. Paolino

Abstract:

This report documents the theory and experimental results of an investigation of microstrip patch antennas for planar monopulse service. This was a study of a simple linear traveling-wave array with monopulse processing to acquire knowledge of some of the problems peculiar to these arrays. Several unexpected problems appeared during the experimental phase of this effort. Some fixes were found and documented here. Also included is a description of the single-patch analysis of radiation and scattering (RCS), along with an array-synthesis technique. Both of these yielded good experimental correlation. The appendixes provide computer program listings implementing these techniques and a brief description of their logic. This is an informal report of the Naval Weapons Center and is not a part of the permanent records of the Department of Defense.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-88-T-002

Report Classification:
UNCLASSIFIED

Title: Severe Thermal Environment Protection System (STEPS) JP-5 Pool Fire Tests

Issued: September 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Linda Haynes, NWC, Code 3386

Abstract:

Wire bundles, representative of the construction of those found in F-18, were placed in thermal protective sleeving and powered. These bundles were tested in an uncontrolled JP-5 pool fire to determine how long they could survive under thermal conditions. The results of the four tests are contained in this report.

Report No.:
JTCG/AS-88-SM-003

Report Classification:
UNCLASSIFIED

Title: How IRVING (Infrared/Visible Imaging - Numerically Generated) Works - Descriptions of Procedures, Algorithms, and Submodels in IRVING

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
T. L. Barnett

Abstract:

The mathematics and physics involved in the IRVING models and subprograms is described in "How IRVING Works." This is a companion document to "Users' Manual for IRVING," and is used primarily to better understand the procedures in depth. To complete a working set of IRVING, a user must obtain a personal computer executable copy of LOWTRAN 6.0 to modify the source code and recompile QuickBasic is needed, and to utilize the mouse compatible features a mouse and appropriate mouse driver is needed. A set of 7 floppy disks are filed with this report.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-88-SM-002
AD/EN-TR-88-1001

Report Classification:
SECRET

Title: HAVE ACRE Warhead Threat Performance Data Array (U)

Issued: May 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division,
Eglin AFB, FL

Author(s):
Lillard E. Gilbert

Abstract:

(U) The HAVE ACRE Warhead Threat Characterization Program was conducted specifically to provide fragment weight, shape, material, weight frequency, velocity decay, initial velocity, and spatial dispersion information in a simple data array that defines the warhead capability to generate an antiaircraft threat. The missile warhead threat performance data array was developed for use in evaluating the vulnerability of combat aircraft and flight vehicle protection concepts. The information in this report was generated from the analysis of the HAVE ACRE Warhead test data.

Report No.:
JTCG/AS-88-SM-001
ASD-TR-87-5031

Report Classification:
UNCLASSIFIED

Title: A Summary of Aerospace Vehicle Computerized Geometric Descriptions for Vulnerability Assessments

Issued: May 1987 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
G. Bennett, ASD

Abstract:

This report presents the results of an update of a 1982 survey and summary of computerized geometric models of aeronautical systems being developed by the DoD for use in vulnerability assessments. These geometric representations are developed using the tri-service documented MAGIC, SHOTGEN, FASTGEN III, GIFT, or SCAN computer programs. Summaries of existing models are grouped by US aircraft, helicopters, and satellites, US missiles and target drones, generic aircraft components, foreign aircraft and helicopters, foreign missiles and target drones, and SCAN target descriptions. A brief summary of each geometric model is presented and a DoD point of contact for obtaining it is identified. The report is printed in a loose leaf format to permit future revisions by a page update procedure.

Report No.:
JTCG/AS-88-CM-001
AFWAL-TR-88-1086

Report Classification:
SECRET

Title: Pyrotechnic Expendable Laser Jammer Configuration (U)

Issued: October 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Sanders Associates
95 Canal Street
Nashua, NH

Author(s):
Cathy Reed, James Beattie, Patrick Perkins, and Evan Chicklis of Sanders Associates, Inc.

Abstract:

(U) Detailed abstract is classified. This final report describes the 31-month effort on USAF Contract F33615-85-C-1701 entitled "Pyrotechnic Expendable Laser Jammer Configuration." The work was performed by Sanders Associates, a Lockheed Corporation, 95 Canal Street, Nashua, NH. This effort was jointly funded by AFWAL Project 2000 and JTCG/AS.

Report No.:
NWC TP 6837

Report Classification:
SECRET

Title: RF Interactive Scattering Analysis System and its Validation (U)

Issued: September 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Wang, Helen T. G. and Clark, Timothy S.

Abstract:

(U) This report documents the results of a study of the RF interactive scattering analysis system and its validation. The objective of this project is to build an RF interactive system that would efficiently use the best parts of several different radar cross section (RCS) codes and be able to interact between the RCS codes. The approach taken with this work is fourfold: (1) write a preprocessor program to make the modeling task efficient, (2) write an executor program to select the appropriate code to use in each aspect angle region and combine the output results of all of them, (3) validate the combined RCS code against measured results, and (4) display the RCS level of each component of the target based on a color code.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-87-T-006

Report Classification:
UNCLASSIFIED

Title: Compartmentalized Aircraft Wing Tank Active Ullage Explosion Suppression Tests

Issued: July 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
J. Hardy Tyson

Abstract:

This report documents the second in a series of gun fire tests evaluating the performance of an active ullage explosion suppression system. Even though the system as tested had a significant effect of the peak pressure and rise time of the pressure, based on our acceptance criteria of keeping the peak pressure below 10 psig, the system did not work. It is recommended that for future work in active ullage explosion suppression, employing Halon, the transportation distance of the Halon should be minimized. This would directly affect the time of the arrival of the suppressant and it is felt that suppression could be achieved. Appendix C includes pressure data from all tests.

Report No.:
JTCG/AS-87-T-005
AFWAL-TR-88-3014

Report Classification:
UNCLASSIFIED

Title: Survivability Characteristics of Composite Compression Structures

Issued: May 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Allen, M. R., Avery, J. G.

Abstract:

This report presents work accomplished from February 1984 to May 1988. The program objectives were to develop new design concepts and to verify analysis methods for improved survivability of composite compression structures to ballistic weapon threats. The approach to achieve these objectives included a two part program to resolve data deficiencies and incorporate program results into design practice through development of design guidelines. Part one established and compared the survivability performance of advanced composite materials and survivable concepts by testing flat panels under compression loading against the advanced survivable designs. Part two extended and validated these results for application to full-scale multi-loadpath structure by ballistic testing three survivable compression covers on a single box-beam component. All four covers were impacted with three fragments under load to 0.0016 in/in strain, cyclic loaded and then statically loaded to either failure or 0.004 in/in strain level.

Report No.:
JTCG/AS-87-T-004

Report Classification:
UNCLASSIFIED

Title: A Ballistic Evaluation of Light-Weight Void Fillers

Issued: October 1987 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
M. Mercer

Abstract:

This report documents a series of tests evaluating 16 different powder systems for aircraft dry bay fire protection. There were two phases of testing. Phase I consisted of 49 ballistic tests using a dry bay simulator, and phase II tested the ruggedness of each system to handling. The threat used during phase I testing was the 23-mm HEI-T.

Report No.:
JTCG/AS-87-T-002
NRL Memo Report 6048

Report Classification:
UNCLASSIFIED

Title: High Intensity Laser Irradiation Effects on Double-Lap and Step-Lap Graphite/Epoxy to Titanium Adhesively Bonded Joints

Issued: March 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
Washington, DC 20375-5320

Author(s):
Jones, Harry N.; Stonsifer, Fred R.; Chang, Chinee I.; Wissinger, Gregory W.

Abstract:

Increased use of composite materials in aircraft structures necessitates joints between metallic and composite components. While the strength degradation effects of high intensity laser irradiation of both metals and composites have been studied in the past, this has not been done on any of the bonded joint designs that now exist in many aircraft structures. Two joint designs, a step-lap and a double step-lap typically used in airframe construction were chosen for study. The primary objective of the tests discussed in this report was to make observations on failure modes of these joints when exposed to high intensity heat sources and provide a basis for development of a failure model. These tests provide a starting point for a more detailed understanding of the failure mechanisms involved and a basis for making a rational vulnerability assessment.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-87-T-001
MTL TR 87-43

Report Classification:
UNCLASSIFIED

Title: Degradation in Structural Load Capacity of Bonded Composite Aircraft Joints Due to Failure of the Adhesive Bond as a Result of Ballistic Impact

Issued: August 1987 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Army Material Technologies Laboratory,
Watertown, MA 02172-0001

Author(s):
Muldoon, Robert A.

Abstract:

The results of a preliminary experimental program designed to determine the degradation in the structural load capacity of bonded composite aircraft joints due to failure of the adhesive bond resulting from ballistic attack by fragments produced from the detonation of a 23mm HEI-T projectile are presented. An analysis of the fragment spray produced indicated that the most lethal fragment could be reproduced by the .30 cal. FSP round which is used exclusively for ballistic tests performed in this study. 7075-T73 aluminum clad celion G-50 graphite/epoxy composite material was used in the test program. The aluminum plate was bonded front and back to the composite using EA 9309 adhesive. A range of impact velocities was investigated for applied loads of 1,000, 5,000 and 10,000 lbs. The reduced structural load capacity of the specimens as measured after ballistic impact is plotted and discussed.

Report No.:
JTCG/AS-87-SM-008
AFWAL-TR-88-3051

Report Classification:
UNCLASSIFIED

Title: ESAMS Computer Program - User's Manual

Issued: August 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
SURVIAC

Author(s):
Kevin Crosthwaite, AFWAL/FIES/SURVIAC

Abstract:

ESAMS is a generic computer program which can be used to model surface-to-air missile systems. The model currently has the capability of assessing the probability of kill for several foreign missile systems against USAF aircraft. The model simulates the interaction between a single airborne target and a specified SAM missile fired from a designated location. The characteristics modeled include sensor lock-on and tracking parameters, missile flight dynamics (including aerodynamics and propulsion(, missile guidance and control, target vulnerability, and countermeasures.

Report No.:
JTCG/AS-87-SM-007
WRDC-TR-89-6008

Report Classification:
UNCLASSIFIED

Title: ESAMS Computer Program - Programmer's Manual

Issued: September 1989 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
WL/TXAA
WPAFB, OH 45433

Author(s):
Mumford, K., Crosthwaite, K., Hamilton, L., Egner, D., et al.

Abstract:

ESAMS is a generic computer program which can be used to model surface-to-air missile systems. The model currently has the capability of assessing the probability of kill for several foreign missile systems against USAF aircraft. The model simulates the interaction between a single airborne target and a specified SAM missile fired from a designated location. The characteristics modeled include sensor lock-on and tracking parameters, missile flight dynamics (including aerodynamics and propulsion), missile guidance and control, target vulnerability, and countermeasures.

Report No.:
JTCG/AS-87-SM-006
AFWAL-TR-88-3087 &

Report Classification:
SECRET

Title: ESAMS Computer Program - Analyst Manual, Missiles, Parts 1-12 (U)

Issued: July 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
SURVIAC

Author(s):
R. S. Baty, B. L. Burel, D. J. Carlson, K. M. Mumford, K. R. Crosthwaite, L. A. Hamilton, et. al.

Abstract:

(U) ESAMS is a generic computer program which can be used to model surface-to-air missile systems. The model currently has the capability of assessing the probability of kill for the Soviet SA-2 through SA-14 missile systems against air vehicles. The model simulates the interaction between a single airborne target and a specified SAM missile fired from a designated location. The characteristics modeled include sensor lock-on and tracking parameters, missile flight dynamics (including aerodynamics and propulsion), missile guidance and control, target vulnerability , and countermeasures. Specific missiles are modeled in Parts 2 through 12 as follows: Part 2 - SA-2; Part 3 - SA-3; Part 4 - SA-4; Part 5 - SA-5; Part 6 - SA-6; Part 7 - SA-7 and SA-14; Part 8 - SA-8; Part 9 - SA-9 and SA-13; Part 10 - SA-10; Part 11 - SA-11; Part 12 - SA-12.

Report No.:
JTCG/AS-87-SM-005
AFWAL-TR-88-3051

Report Classification:
UNCLASSIFIED

Title: Enhanced Surface-to-Air Missile Simulation (ESAMS) Computer Program - Analyst Manual, Basic Methodology

Issued: August 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
SURVIAC

Author(s):
Kevin Crosthwaite, AFWAL/FIES/SURVIAC

Abstract:

ESAMS is a generic computer program which can be used to model surface-to-air missile systems. The model currently has the capability of assessing the probability of kill for several foreign missile systems against USAF aircraft. The model simulates the interaction between a single airborne target and a specified SAM missile fired from a designated location. The characteristics modeled include sensor lock-on and tracking parameters, missile flight dynamics (including aerodynamics and propulsion(, missile guidance and control, target vulnerability, and countermeasures.

Report No.:
JTCG/AS-87-SM-004

Report Classification:
UNCLASSIFIED

Title: Vulnerability of Shielded Piping for Aircraft Engines

Issued: April 1988 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Philip Niebuhr

Abstract:

The testing reported here was prompted by the survivability enhancements being incorporated into the V-22 Osprey's T406-AD-400 engine. The VSTOL tiltrotor V-22 contains two T406 turboshaft engines being developed by the Allison Division of General Motors. One T406 engine can provide enough power to sustain conventional flight. Thus the disabling of one engine, short of dislodging the engine from the aircraft, does not constitute a KK-kill (catastrophic failure of the aircraft). Because of this redundancy, the probability of a KK-kill due to the loss of an oil or fuel line by a ballistic threat is very low. However, the loss of an oil or fuel line does result in a high probability of a B-kill (mission abort). If the survivability of these lines can be enhanced without a significant weight penalty, the aircraft's mission survivability can be increased greatly.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-87-SM-001

Report Classification:
SECRET

Title: RCS Codes Analysis and Comparison (U)

Issued: March 1987 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
T. G. Helen Wang (NWC Code 3313); Harold A. Brooks (Code 33812)

Abstract:

The far-field RCS of a target is independent on the range but dependent on the shape and material composition of the target as well as the polarization, frequency and aspect angle of the incident wave.

This report documents the results of modeling studies done on a cylinder, a plate, a cube and a missile, using four different RCS computer codes. The results from different RCS computer codes are analyzed and compared to evaluate the RCS codes.

Report No.:
JTCG/AS-86-T-002

Report Classification:
UNCLASSIFIED

Title: Design, Fabrication and Testing of a Battle Damage Repair Kit for "Control-by-Wire" Aircraft

Issued: October 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
ORFI Systems, Inc.

Author(s):
Adelbert W.Campbell

Abstract:

This is a report on the investigation into and development of a land based repair system usable under combat conditions for control-by-wire (CBW) aircraft having sustained ballistic and/or thermal damage to one or more channels of electrical flight control wiring.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-86-T-001

Report Classification:
UNCLASSIFIED

Title: Hybrid Composite Response to Hydraulic Ram

Issued: October 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Scott Lang; Jamie Childress; Todd Anderson

Abstract:

Hydraulic Ram is a major damage mechanism in fuel tanks that are impacted by projectiles. Composite materials have proved vulnerable to hydraulic ram in ballistic testing. Hybridizing graphite/epoxy structures with materials such as fiberglass, nylon, or Kevlar shows promise for reducing the vulnerability of composite structures to hydraulic ram. This report presents the results of ballistic testing of small test panels hybridized with several materials in several different configurations. Many configurations and materials provide significant improvement over baseline graphic panels and are recommended for further testing.

Report No.:
JTCG/AS-86-SM-002
NWSC/CR/RDTN - 258

Report Classification:
UNCLASSIFIED

Title: NSAMS Surface-to-Air Missile Simulation Users Manual (NWSC/CR/RDTR-258)

Issued: September 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Weapons Support Center
Crane, IN 47522-5001

Author(s):
William W. Newton, and J. Cabot Faultless

Abstract:

This manual provides information required to successfully use the NSAMS Surface-to-Air Missile Simulation. Included is an overview of the simulation structure, input data requirements and formats, descriptions of running time options, descriptions of output options, and a trouble shooting guide. NSAMS is an adaptation of the ESAMS Simulations.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-86-SM-001
NWSC/CR/RDTR-301

Report Classification:
SECRET

Title: ESAMS Surface to Air Missile Simulation - ECM Applications Manual (U)

Issued: May 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Weapons Support Center, Crane, IN

Author(s):
L. C. Hitchcock

Abstract:

(U) This is a User's Manual for the ECM options in the ESAMS Surface-to-Air Missile Simulations. It contains information necessary for the simulation user to effectively use the ECM options in the ESAMS programs.

Report No.:
JTCG/AS-86-CM-002

Report Classification:
SECRET/NOFORN

Title: Survivability & Hardening of Tactical Aircraft in a Laser Incurred Threat Environment (SHOTLITE) (U)

Issued: March 1987 Final

Sponsor:
Naval Research Laboratory
Washington, D.C.

Performing Organization:
Verac, Inc.

Author(s):
Dr. George Mueller, NRL

Abstract:

(U) The SHOTLITE study, performed under the sponsorship of the JTCG/AS, examined the ground based battlefield laser threat in a tri-service aircraft mission environment. Tri-service (Air Force, Army, and Navy/Marine Corps) aircraft, systems, and missions were considered in the development of the impacts of a laser threat on aircraft survivability. Survivability analysis was used to provide a criticality ranking of various vulnerable aircraft components. Requirements for, and benefits and penalties of, hardening the critical aircraft components were analyzed and have been discussed in the Final Report. The SHOTLITE analysis, as presented in the program Final Report, provides a needed baseline of tri-service aircraft vulnerability to the potential battlefield laser threat, and also yields valuable insight into the nature of aircraft laser vulnerability and the most desirable hardening responses.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-86-CM-001
AFWAL TR-85-1168

Report Classification:
SECRET

Title: Electro Optical/Radio Frequency Decoy (U)

Issued: April 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Avionics Directorate
WPAFB, OH

Author(s):
K. Jacobson, H. Herm, D. Moore, et. al.

Abstract:

(U) A study was performed to integrate Electro-Optical and radar frequency signature augmentation devices on a penetration aid decoy platform. Previous efforts were reviewed and compared with current tactical mission doctrine. Updated decoy requirements were then developed and traded-off in a utility analysis of cost and effectiveness measures. Preliminary designs were produced for two configurations with other variations, of mission specific design, evaluated for comparison. It was determined that a modular payload was suited for these designs, allowing a broader application of the decoy concept. This program sets the basis for advanced development of the integrated EO/RF decoy which can effectively counter the integrated threat.

Report No.:
AFWAL-TR-86-3064, Volume I

Report Classification:
UNCLASSIFIED

Title: Aircraft Battle Damage and Repair Volume I, A Survey of Actual Combat Experience

Issued: August 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Vice, John M.; Lindenmuth, James R., and Foulk, Jeffrey, The SURVICE Engineering Company

Abstract:

During the Southeast Asia conflict, a concerted effort was made to record the details of individual combat damage incidents in which damage or loss occurred to U.S. aircraft. One primary collection method used was on-site data-gathering by Battle Damage Assessment and Reporting Teams (BDART). These teams were operational from July 1969 through September 1971 and, briefly, in December 1972. As a result of the BDART and other data collection activities, a considerable amount of information was gathered documenting the mission scenario, threat, threat effects, damaged systems and subsystems, repair required and, in many cases, photographs depicting the damage and repair.

This report is Volume I of three volumes, which describes the results of a comprehensive review and analysis of selected individual combat damage incident folders from the SURVIAC collection. Volume I gives a pictorial representation of actual combat damage, actual battle damage repair, and a description of the hours, skills and parts needed. Volumes II and III summarize, analyze and present the damage and repair data.

Report No.:
JTCG/AS-85-T-002

Report Classification:
UNCLASSIFIED

Title: Ram Tolerant Fuel Tank Components

Issued: February 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Jamie Childress, Eric Lundstrom

Abstract:

Aircraft fuel systems were subjected to hydraulic ram by armor piercing and high explosive projectiles. Fuel tank components were examined after testing for hydraulic ram damage.

Report No.:
JTCG/AS-85-SM-007

Report Classification:
UNCLASSIFIED

Title: Laser Propagation Considerations for Modeling

Issued: June 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Dr. V. Gail Hempley

Abstract:

This paper only describes interactions that occur as a laser beam travels through the optical train of the laser system and then through the atmosphere. Each encountered phenomenon is described as conceptually and physically as possible. Most of the modeling descriptions in this paper have been taken from the Engagement simulation Model. This model evolved from the engineering development community. It appears to contain the most complete attempt to provide each phenomenon with a model. It is also widely accepted among the high energy laser development community although other methods of modeling each phenomenon have been indicated where they were known, there has been no attempt to provide a complete spectrum of models.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-85-SM-006

Report Classification:
UNCLASSIFIED

Title: Survivability Methodology Requirements Definitions Study Summary and Results

Issued: December 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Dr. V. Gail Hempley

Abstract:

The JTCG/AS has initiated a program to establish a suite of models that will provide analytical modeling required during the evaluation of tactical survivability issues. In this study, the basic requirements for this model structure are investigated. Section II describes these requirements and then relates them to the current state of the ASMR models. The other major part of this study was to examine the effectiveness of the methods of interfacing with the survivability community.

Report No.:
JTCG/AS-85-SM-003
AFWAL-TR-85-3104

Report Classification:
SECRET (Vol III) UNCL (rem.)

Title: Laser Threat Model Manuals — Vol I (Analyst's Manual), Vol II (User's Manual) (U), Volume III (Data Base Manual), Vol IV (Data Base Specifications Manual), Vol

Issued: December 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
Peggy Wagner, AFWAL

Abstract:

The purpose of these manuals are to provide the programming user of the Laser Threat Model with the information necessary for the construction of the system files, tables, dictionaries, and directories.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-85-SM-001

Report Classification:
UNCLASSIFIED

Title: Interface Between Missile Intelligence Agency Simulations and Naval Weapons Center Endgame Models

Issued: October 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Dorothy Saitz

Abstract:

Missile Intelligence Agency (MIA) simulation data (Endgame Encounter Conditions) are available for input to the Naval Weapons Center endgame simulation MECA (Modular Endgame Computing Algorithms). This report documents the interface (method) between the MIA simulation and the NWC endgame models.

Report No.:
JTCG/AS-85-CM-004
AFWAL-TR-85-1180

Report Classification:
UNCLASSIFIED

Title: Optical Zinger (OZ) Model Documentation (U) (AFWAL-TR-85-1180)

Issued: February 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
4555 Overlook Ave., SW
Washington, D.C. 20375-5320

Author(s):
Quest Research Corp.

Abstract:

(U) Optical Zinger (OZ) is a combined detection, engagement, and cost assessment model developed to investigate the effectiveness of optical and electro-optical countermeasures (OCM/EOCM) in enhancing aircraft survivability. This manual is oriented toward the engineering/mathematical modeler.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-85-CM-003
AFWAL-TR-851179

Report Classification:
UNCLASSIFIED

Title: EOCM Effectiveness Measures Simulation Development

Issued: February 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
4555 Overlook Ave., SW
Washington, D.C. 20375-5320

Author(s):
Quest Research Corp.

Abstract:

Optical Zinger (OZ) is a combined detection, engagement, and cost assessment model developed to investigate the effectiveness of optical and electro-optical countermeasures (OCM/EOCM) in enhancing aircraft survivability. This report discusses the historical development of the model, the current status of the model, and some of the most important applications.

Report No.:
JTCG/AS-85-CM-002

Report Classification:
SECRET

Title: Fire Control System Survivability Analysis Technical Note - Biological Effects Caused by High-Power Microwave Weapons (U)

Issued: January 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
4555 Overlook Ave., SW
Washington, D.C. 20375-5320

Author(s):
Quest Research, Inc.

Abstract:

(U) This document summarizes the microwave threat and exposure levels that could be experienced by a pilot during standard DoD scenarios. It summarizes human biological effects resulting from varying microwave exposure levels as found in literature during the period from 1956 to 1982. Finally, critical effects and exposure levels are evaluated and summarized.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-85-CM-001

Report Classification:
SECRET/NOFORN/WNINTEL

Title: Fire Control Systems Survivability Analysis (U)

Issued: September 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
4555 Overlook Ave., SW
Washington, D.C. 20375-5320

Author(s):
George Mueller, NRL/Quest Research

Abstract:

(U) For the Vulnerability to Directed Energy Weapons (VUDEW) Committee of the JTCG/AS, Quest Research Corporation identified and quantified the vulnerability of selected weapons systems, and fire control and other mission-critical systems to projected/postulated threat High-Power Microwave (HPM) Directed Energy Weapons (DEWs). The impact of the use of current hardening techniques was included in the scope of the study. The study examined the vulnerability of the F-16 and F-18 aircraft and the AAH-64 Advanced Helicopter. Scenarios depicting the unique combat environment for each of the systems were used to support the analysis. A final report summarized the results of the investigation and provided recommendations for further analysis and additional testing. NRL point of contact is Dr. George Mueller.

Report No.:
JTCG/AS-84-T-001
AFWAL TR-85-3028

Report Classification:
UNCLASSIFIED

Title: Soviet 30mm (155-A30) HEI Projectile Threat Performance Model

Issued: December 1984 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
L. E. Gilbert, T. Seymour

Abstract:

The Soviet air-to-air 30-mm, 155 gunfired high explosive incendiary (HEI) projectile threat characterization program was conducted specifically to provide fragment decay, initial velocity, and spatial dispersion information in a simple model characterizing the threat. The threat model was developed for use in evaluating the vulnerability of USAF combat aircraft and flight vehicle protection concepts. The information contained in this report was generated in-house by the test, and reduction and analysis of data from three, 30-mm 155 HEI projectiles. The 30-mm program demonstrated the in-house capability of the flight vehicle protection branch to conduct gunfired HE projectile threat characterization test programs.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-84-SM-003
AFWAL TR-84-1020

Report Classification:
UNCLASSIFIED

Title: A Multi-path Clutter Model for Surface-to-Air Missile Simulations (SAMS) (AFWAL-TR-84-1020)

Issued: April 1984 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Avionics Laboratory (AFWAL/AAWA-1)
WPAFB, OH 45433

Author(s):
M. West

Abstract:

This report summarizes a study whose objective was to reformat the clutter multipath model used in the TAC ZINGER'S for inclusion in the top down SAMS. This study used the top-down code generated from the original program by another organization in conjunction with the original program in an attempt to provide a documented, structured Fortran implementation of the original model. In most instances, the original authors were able to provide code sections. The model is still limited to the same threats as the original track-while-scan model.

Report No.:
JTCG/AS-83-T-004

Report Classification:
UNCLASSIFIED

Title: Aircraft Hydraulic Centrum Concept: Design and Survivability Analysis

Issued: March 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA 18974-9000

Author(s):
C. E. Knezek, J. E. Garner, and J. K. Trotter, General Dynamics Corp.

Abstract:

The Navy Armored Hydraulic Centrum Investigation analyzes the impact of utilizing centrum concepts in hydraulic system design concepts to yield increased aircraft survivability. The program objectives are: (1) develop centrum design concepts that increase survivability, (2) evaluate these concepts by quantifying survivability improvements, and (3) recommend hydraulic system design techniques that will increase survivability. The approach taken consisted of the following tasks: (1) Development of a baseline configuration that represents a current technology aircraft hydraulic system. (2) Development of two hydraulic system design options incorporating hydraulic-centrum system features that increase aircraft survivability. (3) Evaluation of the relative merit of these options by comparison to the baseline configuration. (4) Preparation of a design recommendations report.

Report No.: JTCG/AS-83-T-003

Report Classification: UNCLASSIFIED

Title: Survivability Assessment and Design Guide for Light Weight Hydraulic Systems (8000 psi)

Issued: May 1984 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA 18974-9000

Author(s):
R. B. Olsen

Abstract:

Five hydraulic systems were analyzed using the quick analysis method to determine probability of kill data for two ground attack missions. The baseline system was the A-7E aircraft 3000 psi hydraulic system. An equivalent 8000 psi baseline system and three highly survivable systems were defined. Conversion of the baseline 3000 psi system to the equivalent 8000 psi system resulted in an average of 39.7 percent reduction in probability of kill for flight controls. Use of 8000 psi operating pressure with electro-hydraulic poser packs resulted in an average reduced Pk of 91.6 percent for flight controls compared to the baseline 3000 psi system.

Report No.: JTCG/AS-83-T-002

Report Classification: UNCLASSIFIED

Title: Proceedings of the Conference on Design of Armor Systems (U)

Issued: September 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Systems Command

Author(s):
Compiled by Irene Dorr, Booz-Allen & Hamilton, Inc.

Abstract:

(U) These proceedings cover papers presented at the conference on the design of armor systems. The conference was held at the Naval Postgraduate School, Monterey, CA on 19-21 April 1983. Individual articles from this conference have been entered in the S/V Reference Library at SURVIAC and carry file numbers 03987A through 03988N.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-83-CM-002
USA AVSCOM TR 85-D-16

Report Classification:
SECRET

Title: Helicopter Canopy Multi-ply Laser Countermeasures (U)

Issued: May 1986 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S. Army Aviation Technology Directorate
Safety & Survivability Dir. Bldg 401
Ft. Eustis, VA 23604-5577

Author(s):
Penunuri, Barbara

Abstract:

(U) The objective of this program was to develop and validate a transparent enclosure that would protect the aircrew of an AH-1S helicopter from high- and low-energy laser emission, from flashblindness induced by a nuclear blast or laser-induced reradiation, and to provide this protection with a sufficient structural integrity to withstand the overpressure from a nuclear blast.

Report No.:
JTCG/AS-83-CM-001
TA-1-02

Report Classification:
SECRET

Title: Fire Control System Survivability Analysis (U)

Issued: December 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
4555 Overlook Ave., SW
Washington, D.C. 20375-5320

Author(s):
Gene Kempe, Quest Research

Abstract:

(U) This document is an interim technical report that summarizes and discusses results to date of an ongoing investigation to identify and quantify potential vulnerabilities of U. S. aircraft fire control systems and other mission-critical avionics systems to high-power microwave directed energy weapons (DEWS) that might be deployed in the near future.

Report No.:
JTCG/AS-82-C-001
TR-83-D-10

Report Classification:
UNCLASSIFIED

Title: Helicopter Mounted Turret Smoke Launcher Test

Issued: March 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S. Army Aviation Technology Directorate
Safety & Survivability Dir. Bldg 401
Ft. Eustis, VA 23604-5577

Author(s):
L. Dikant

Abstract:

An experimental smoke/aerosol countermeasure system for helicopters has been designed, fabricated, and flight tested on an AH-1S helicopter. The system consists of a six-round turret launcher developed jointly by the Applied Technology Laboratory and Boeing Aerospace Company and specially designed red phosphorous smoke grenades developed by the US Army Chemical Systems Laboratory. During flight tests conducted at the Aviation Development Activity (Ft. Rucker, AL), 84 smoke rounds were fired from a hovering AH-1S. The turret launcher and smoke rounds generally performed according to design specifications. A two-round burst produced effective visual masking of the aircraft.

Report No.:
NAWCWPNS TP 8172

Report Classification:
CONFIDENTIAL-NOFORN

Title: Sidewinder Rocket Motor Fragment Impact Response for Aircraft Survivability Assessment (U)

Issued: December 1993 Interim June 93 - Sept 93

Sponsor:
Joint Technical Coordinating Group on Aircraft Survivability
Crystal Square #2, Suite 1003
1725 Jefferson Davis Highway
Arlington, VA 22202-4102

Performing Organization:
Naval l Air Warfare Center Weapons Division
China Lake, CA 93555-6001

Author(s):
S. A. Finnegan, O.E.R. Heimdahl, J.K. Pringle, J. Covino, and L. Budd

Abstract:

(U) The MG-841 reduced-smoke Sidewinder propellant was studied in the Burn-to-Violent Reaction (BVR) test configuration at NAWCWPNS. The study was an initial effort to develop predictive methods for determining the response of tactical motors to bullet and fragment impact in order to help establish survivability criteria for aircraft containing missile stores.

(U) The BVR experimental technique is discussed, and specific propellant data are presented and analyzed. From these data a mechanical and reactive model was developed. To validate both the BVR test results and the initial model predictions, impact tests on actual Sidewinder Mk 36 Mod 11 rocket motors containing the MG-841 propellant were conducted. Test results agreed well with the model predictions.

Report No.:
JTCG/AS-82-T-002

Report Classification:
UNCLASSIFIED

Title: Development and Testing of Dry Chemicals in Advanced Extinguishing Systems for Jet Engine Nacelle Fires

Issued: February 1983 Final

Sponsor:
Naval Weapons Center
China Lake, CA 93555

Performing Organization:
Dept of Chemistry and Civil Engineering
San Jose State University
San Jose, CA

Author(s):
R. L. Altman, A. C. Ling, L. A. Mayer, et. al.

Abstract:

This document reports an experimental study of the effectiveness of dry chemical in extinguishing and delaying re-ignition of fires resulting from hydrocarbon fuel leaking onto heated surfaces such as can occur in jet engine nacelles. The commercial fire extinguishant dry chemicals tried were, for example, sodium and potassium bicarbonate, carbonate chloride, and carbamate (monnex) but we have also tested other metal-halogen and metal-hydroxycarbonate compounds prepared in our own laboratories. Given in this report are: synthetic and preparative procedures for new materials developed; a new concept of fire-control by dry chemical agents; descriptions of experimental assemblages to test dry chemical fire extinguishant efficiencies in controlling fuel fires initiated by hot surfaces; comparative testing data for more than 25 chemical systems in a static assemblage with no airflow across the heated surface, and similar comparative data for more than 10 compounds in a dynamic system with airflows up to 350 ft/sec; and recommendations for future work with one system that fulfills all requirements delineated by the sponsoring agency, and which has been tested in both the static and dynamic assemblages with both methodologies confirming it as the most effective system by comparison with other materials tested.

Report No.:
JTCG/AS-82-T-001

Report Classification:
UNCLASSIFIED

Title: Evaluation of Flight Control Signal Lines

Issued: April 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA

Author(s):
W. C. Mangum, W. H. Lewis, T. W. Jansen

Abstract:

Survivability of flight control signal lines between pilot and flight control surfaces is investigated. The threat environment considered was ballistically caused fires specifically on fly-by-wire aircraft such as the F-16 and F-18 and resulting survivability of command and feedback wires. Fluidic and fiber optics systems are investigated for use as backup flight control signal lines and their survivability when exposed to the fire environment.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-82-SM-008
NWC Tech Memo 4990

Report Classification:
UNCLASSIFIED

Title: Long-Range Air-to-Air Combat Methodology (LRAACM)

Issued: March 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Brad Kowalsky, NWC, Code 3381

Abstract:

To establish a standardized methodology for the evaluation of long-range air-to-air combat, many existing methodologies were examined. That examination was fruitless, and it was decided to develop the architectures for eight air-to-air combat situations leading toward a comprehensive and specialized methodology for long-range air-to-air combat engagements. Those architectures are described in this report.

Report No.:
JTCG/AS-82-SM-005
AFWAL-TR-83-3047

Report Classification:
CONFIDENTIAL

Title: Dynamic Warhead Fragment Threat Model Validation (U)

Issued: September 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
L. E. Gilbert

Abstract:

This report contains the results of the validation of the dynamic warhead fragment threat model. The model was developed to provide accurate anti-aircraft missile warhead and gunfired projectile fragment threat information to the aircraft survivability and intelligence technical communities. The threat information provided by the model are fragment velocity and frequency per unit area at the aircraft interface.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-82-SM-004

Report Classification:
UNCLASSIFIED

Title: Summary of Aerospace Vehicle Computerized Geometric Description for Vulnerability Assessments

Issued: December 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Gerald Bennett, ASD

Abstract:

This report presents the results of an update of a 1975 survey and summary of computerized geometric models of aeronautical systems being developed by the Services for use in vulnerability assessments. The geometric representations are developed using the tri-service documented MAGIC, SHOTGEN, FASTGEN II, OR GIFT computer programs. Specialized geometric descriptions are also developed for the tri-service documented SCAN missile end-game simulation. The geometric models are grouped by domestic aircraft, helicopters and satellites, domestic missiles and target drones, foreign aircraft and helicopters, foreign missiles and target drones, aircraft components, and SCAN missile end-game models. Brief summaries of each of the target description efforts are presented and government points of contact are identified.

Report No.:
JTCG/AS-82-SM-003
ASD XRM-TR-82-5027

Report Classification:
SECRET

Title: Vulnerability Predictors for Aircraft and Two Large Threat Weapons (U)

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
G. Bennett

Abstract:

(U) Vulnerability Assessments of various U. S. Aircraft and helicopters to 57mm and SA-7 threats have been performed by government agencies and contractors in support of survivability assessments. This data base is collected, analyzed, and gaps in coverage are identified. Vulnerability assessments are performed on selected aircraft in these areas of weights and presented areas, and the results are used to increase the vulnerability data base. This data base is analyzed and, using regression analysis, equations are fitted to allow prediction of the aircraft presented areas as a function of the weights. Predictors are then developed using the extended data base for estimating the whole aircraft probability of kill as a function of the presented areas.

(U) Vulnerability predictors are developed for the two threats and three design groupings, single engine aircraft, twin-aircraft, and helicopters. For each of these groupings and threats, predictors are developed for each of the major views; top, bottom, front, rear, and side, as well as an average or mean value. The resulting equations provide predictors for estimating the vulnerabilities of conceptual aircraft and are recommended for use in the early design phase before the drawings and data needed to apply the more detailed and accurate assessment procedures are available.

Report No.:
JTCG/AS-82-SM-002
ASD/XRM TR-82-5014

Report Classification:
UNCLASSIFIED

Title: Vulnerability Predictors for Tactical Aircraft and a Small Threat Weapon

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Gerald B. Bennett, J. P. Ryan

Abstract:

Vulnerability predictor models to a small HE threat were generated for the primary aircraft "A" Kill subsystems in ASD-TR-80-5007. That study designated five primary "A" Kill subsystem contributors and generated unhardened predictors for each. In this study the data base and range of coverage is increased and three subsystem groupings are selected for revising predictors to account for hardening. The subsystems selected for modeling with hardening are the crew, wing fuel, and fuselage fuel. Predictors are developed for each subsystem for two or more hardening levels (including unhardened) for the six cardinal views and for the mean or average of the total aircraft.

The data base for the equation models consisted of actual vulnerability assessments of selected U.S. and foreign aircraft. Design information needed to apply the equations are fuel tank weights and sequencing, crew number, and arrangement. Two hardening levels were assigned for crew models (unhardened and hardened); whereas, the fuel tank models included three levels of hardening: unhardened, with internal tank protection, and with internal and external protection. The increased sample size also resulted in improved models for the unhardened condition. All hardened models were found to be functionally related to the same independent variable that was used for the unhardened models. These predictors were generated for preliminary design use and should be replaced by assessments using the normal techniques when drawings, background data and time become available. This is one of two parallel predictor development tasks for differing threat sizes and is the final report on the small HE threat task.

Report No.:
JTCG/AS-82-SM-001
ASD TR-82-5018

Report Classification:
UNCLASSIFIED

Title: Aircraft Combat Damage Repair Estimating Procedures

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
J. J. Flowers, D. H. Kovatch, and R. L. Day, Jr.

Abstract:

This report documents the first phase of a three phase program to develop procedures for estimating combat damage repair time of inflight and parked aircraft. The objectives of this phase were to: (1) review survivability user models that require repair related input data, (2) evaluate an existing repair time data base for completeness and consistency, (3) review mission essential subsystem criteria for acceptable levels of degraded operation, (4) assess repair difficulty in a chemical/biological warfare environment, (5) consider damage assessment and repairability of composite materials and (6) recommend a methodology for a computerized data base for development in Phase II and validation in Phase III.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-82-D-003, (I-VII)

Report Classification:
SECRET

Title: Proceedings of the Fifth DOD Conference on Laser Vulnerability, Effects and Hardening (U) Volumes I through VII

Issued: 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Office of Naval Research, Washington, D.C.

Author(s):
Compiled by Irene Door, Booz, Allen & Hamilton, Inc.

Abstract:

(U) The 5th DoD Conference on Laser Vulnerability, Effects and Hardening was held 12 - 14 October 1982 at the Naval Postgraduate School, Monterey, CA. Volume I of the proceedings contains the introductory overview papers and the papers from the Vulnerability Session. Individual articles from Volume I have been entered in the SURVIAC Laser Reference Library and carry file numbers 230A through 230T. Volume II of the proceedings contains the Papers on Hardening. Individual articles from Volume II have been entered in the SURVIAC Laser Reference Library and carry file numbers 265A through 265T. Volume III of the proceedings contains the Papers on Strategic Vulnerability and Effects. Individual articles from Volume III have been entered in the SURVIAC Laser Reference Library and carry file numbers 266A through 266Z and 267A. Volume IV of the proceedings contains the Papers on Hardening and Personnel Protection. Individual articles from Volume IV have been entered in the SURVIAC Laser Reference Library and carry file numbers 269A through 269Z and 270 and 270A through 270C. Volume V through VII of the proceedings contains the Session V, VIA, VIB and VII. The papers contained herein carry file numbers 00266A thru 00268A and 00268X.

Report No.:
JTCG/AS-81-T-003
TR 81-228

Report Classification:
UNCLASSIFIED

Title: 57mm High-Explosive Projectiles Threat Program Test Results

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center
Dahlgren, VA 22448

Author(s):
Jamison, Michael R.

Abstract:

A 57mm test weapon and 13 rounds of Soviet model UOR-281 ammunition were evaluated. Nose spray fragmentation was collected and analyzed, and various aluminum and titanium armor plates were impacted by fragmentation in a series of dynamic arenas. Projectile velocity decay and blast profile information were also obtained.

Report No.:
JTCG/AS-81-T-002

Report Classification:
CONFIDENTIAL

Title: Testing of Powder Packs and Powder-Filled Structures for Aircraft Fire Protection (U)

Issued: March 1981 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U. S. Army Applied Technology Laboratory
Ft. Eustis, VA

Author(s):
C. Pedriani

Abstract:

(U) The Army is pursuing the development of powder packs and powder-filled structural panels to prevent fires in dry bays adjacent to helicopter fuel tanks which occur as a consequence of an API or HEI ballistic impact. These tests emphasized the identification of fabrication techniques for honeycomb core sandwich panels which contain a fire-suppression powder within the honeycomb so that fire protection can be incorporated into the basic structural element common to many helicopter fuel tanks. This effort was conducted to obtain test data to assist in expanding the potential use of the powder pack concept to other aircraft fuel tank constructions. Twenty-eight tests were conducted using a variety of powder pack and powder-filled structural test specimens on simulated and integral and fuselage fuel tanks exposed to API and HEI-T projectiles with airflow conditions of 20 and 120 knots. Aluminum oxide powder and Monnex were used in the tests.

Report No.:
JTCG/AS-81-S-007
NSWC TR 81-230

Report Classification:
CONFIDENTIAL

Title: Test Report of the Grill Heat I Warhead Arena (U)

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Surface Warfare Center
Dahlgren, VA

Author(s):
Jamison, M. R.

Abstract:

(U) This report provides the results of an arena firing of the GRILL HEAT I warhead. Fragmentation mass, spatial distribution, and velocity profile information were taken in the main beam spray. A large number of armor systems were placed at varying distances around the warhead in the densest portion of the fragmentation pattern.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-81-S-005

Report Classification:
UNCLASSIFIED

Title: Benchmark for the ASALT Program; Assessment of Survivability Against Laser Threats

Issued: September 1981 Final

Sponsor:
Naval Weapons Center
China Lake, CA 93555

Performing Organization:
ASI Systems International

Author(s):
Fred J. Steenrod, John E. Musch

Abstract:

The benchmark run of the ASALT computer program using data for an F-18 aircraft target is documented in this report. Also, described in this report, are several other computer programs that are useful in assembling data for input and output files from the benchmark process are included, so that the report serves as an example of the execution of the ASALT program and the programs which precede it.

Report No.:
JTCG/AS-81-S-004

Report Classification:
UNCLASSIFIED

Title: Assessment of Survivability Against Laser Threats - The ASALT-I Computer Program

Issued: September 1981 Final

Sponsor:
Naval Weapons Center
China Lake, CA 93555

Performing Organization:
ASI Systems International

Author(s):
Fred J. Steenrod, John E. Musch

Abstract:

ASALT-1 is a Fortran computer program used to evaluate the effectiveness of a high-energy laser weapon against an aircraft flying a path previously evaluated for various encounter conditions. The laser weapons system is described by a flux emission function, aiming errors caused by jitter, and slewing limits of the tracking mechanism. The target aircraft is characterized by a set of components which are combined using a fault tree structure. The program output includes a summary for the whole mission which presents probabilities of kill for the total aircraft, its subgroups and components. This manual contains descriptions for the mathematical concepts, the input requirements, and the output for the ASALT-1 program.

Report No.:
JTCG/AS-81-C-003
TR 83-D-16

Report Classification:
SECRET

Title: Helicopter Canopy Removable Sheet Laser Countermeasures (U)

Issued: January 1984 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S. Army Aviation Technology Directorate
Safety & Survivability Dir. Bldg 401
Ft. Eustis, VA 23604-5577

Author(s):
Uram, John Jr.; Penunuri, Barbara; Schlottig, John

Abstract:

(U) This program developed transparent, removable enclosures for an AH-1S helicopter to protect crew members against hazardous high- and low-energy laser radiation. Two approaches were taken to provide the required protection – a flexible, transparent shield and a rigid contoured transparency. Both approaches were characterized, and experimental AH-1S gunner's door transparencies fabricated.

Report No.:
JTCG/AS-81-C-002

Report Classification:
UNCLASSIFIED

Title: Aircraft Infrared Measurements Guide

Issued: March 1983 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Joint Infrared Standards Working Group

Author(s):
W. L. Capps, D. Powlette, S. E. Tate, et al

Abstract:

A reference source for the aircraft infrared measurement community is proposed. The guide provides standard nomenclature, suggested data formats, calibration requirements (including derived mathematics), and measurement methodology. Chapters are also included on developing test plans and writing the formal report. An extensive bibliography contains sections on calculations aids/equation, calibration, radiometry/spectrometry, and radiation sources.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-81-C-001
AFWAL TR-82-3041

Report Classification:
SECRET (Vol I & III)

Title: RCS Design Guidelines: A/C Configuration Selection for RCS Control, Volume I - Final Report, Volume II - Test Report (U)

Issued: August 1982 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright-Patterson AFB, OH

Author(s):
T. G. Dalby, F. W. Fischer, and W. P. Hansen

Abstract:

(U) This study investigated the effects of configurational changes on RCS and, to a limited extent, on performance of typical baseline air vehicles. An extensive study of existing TCS literature was made and a bibliography covering approximately 1,000 documents was developed (Volume 2). Through use of small models and a millimeter wavelength RCS range, experimental analyses were carried out to assess RCS configurations of these vehicles (Volume 3). Variations in performance of these alternate configurations were also assessed. Effects on RCS variations in general aircraft elements were also investigated; in particular, general configuration, inlets/nozzles, fins/control surfaces, antennas and radomes, canopy, and external stores were considered.

Report No.:
NWC TM 4672

Report Classification:
UNCLASSIFIED

Title: The Aircraft Combat Survivability Evaluation Process and its Applications

Issued: December 1981 Final

Sponsor:
NAVAIR

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
Survivability Evaluation Branch, Survivability and Lethality Division, Fuze and Sensors Department, NWC China Lake, CA

Abstract:

This document was prepared as an in-house reference document for use in the survivability evaluation process.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-80-V-003

Report Classification:
UNCLASSIFIED

Title: A Pictorial Review of USAF Aircraft Battle Damage

Issued: December 1981 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
D. Voyls, AFWAL

Abstract:

This report is a photographic compilation of combat damages to U. S. Air Force aircraft in the Southeast Asia Conflict.

Report No.:
JTCG/AS-80-T-003

Report Classification:
UNCLASSIFIED

Title: Development of a Proposed Mil Spec for Survivable Aircraft Structures (Non-nuclear) and Supporting Data for the Proposed Mil Spec

Issued: November 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
J. Avery and W. Herlin, Boeing Seattle

Abstract:

This report presents the results of a program to develop a proposed Military Specification for Survivable Aircraft Structures. It was originally prepared as Volume III of Boeing Document No. D180-25766. Volume I was the proposed Military Specification. Volume II was the supporting Rationale and Background which presented the rationale for each paragraph of the specification. It also provided a viable management decision-making tool in that weight penalties for various degrees of survivability are identified. This report contains a summary of all the pertinent data used in the program, and a step-by-step description of the work performed in implementing the program. The proposed military specification contains the requirements for providing structural survivability to the effects of ballistic damage from projectile or fragment impacts. It is applicable to each phase of aircraft development.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-80-T-001
TR-80-3042

Report Classification:
UNCLASSIFIED

Title: Aircraft Fuel Tank Responses to High Velocity Cubical Fragments

Issued: October 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright Laboratories
WPAFB, OH 45433

Author(s):
L. A. Cross, University of Dayton Research Center

Abstract:

Failure data, displacement data, and pressure data were obtained from laboratory experiments for the impact of steel cubes on water-backed aluminum panels. The panels were made from 2024-T3 and 7075-T6 aluminum varying in thickness from 0.032 to 0.250 inches. The steel projectiles were of 90, 120, and 180 grain weights. The panels were either of plain metal or protected on their rear surfaces by tear-resistant bladders, self-sealing bladders with backing board, or a 10mm thick foam. The data gathered on the damage threshold velocity for graphite-epoxy and aluminum panels backed by stiffeners obtained from earlier studies was also collected and is presented in this report for comparison purposes.

Report No.:
JTCG/AS-80-C-004
TR-81-1105

Report Classification:
UNCL (Vol I), SECRET (Vol II)

Title: Optical Zinger Model - Users Manual (Vol I); Analyst Manual (Vol II) (U)

Issued: August 1981 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright-Patterson AFB, OH

Author(s):
E. Leaphart, WPAFB

Abstract:

(U) This report presents the results, assumptions and rationale of the development of a combination engagement and cost assessment model, designated Optical Zinger (OZ), which incorporates optical countermeasures (OCM) into the TAC ZINGER SAM engagement models, GREATSAM and NEWSAM and P001, the generic family of AAA engagement models.

Report No.:
JTCG/AS-80-C-003
TR-81-1105

Report Classification:
SECRET

Title: Optical Countermeasures Effectiveness Measures Simulation - Vol II (U)

Issued: August 1981 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright-Patterson AFB, OH

Author(s):
A. Luebcke, G. Stoops, and S. Herr, Quest Research Corporation

Abstract:

(U) This report summarizes a digital model development effort to develop a simulation to assess the effects of Optical Countermeasures (OCM) in enhancing aircraft survivability. Volume II implements the OCM Modeling Methodology discussed in Volume I (Report JTCG/AS-79-C-002, and AFWAL-TR-78-187, publication SECRET), which defined modeling techniques and procedures for evaluating measures of OCM effectiveness.

Report No.:
JTCG/AS-80-C-002

Report Classification:
UNCLASSIFIED

Title: Uncertainty Analysis of Optical Measurement Equipment

Issued: November 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
J. Mudar, Environmental Research Institute Of Michigan

Abstract:

A general methodology of conducting an uncertainty analysis on optical measurement equipment starting with a defining measurement equation is discussed. The general methodology is then applied to an infrared imaging radiometer and two infrared spectroradiometric systems. The imaging system is the Beam Approach Seeker Evaluation System (BASES) at Eglin AFB, FL. One of the spectro-radiometers is the Infrared Spectral Measurement System (ISMS) at the Army White Sands Missile Range, the other is the SPEC LAB spectro-radiometer at the Naval Weapons Center, China Lake, CA.

Report No.:
JTCG/AS-80-C-001 (Vol II)
TR-78-25

Report Classification:
UNCLASSIFIED

Title: Infrared Emissions Analysis Utility Matrix for Inflight Aircraft - Volume II, Analyst Manual

Issued: June 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
Wright-Patterson AFB, OH 45433

Author(s):
C. W. Stone, R. B. Edleman, P. T. Harsha, and F. G. Smith, Science Applications, Inc.

Abstract:

A means of determining which of the available IR signature model(s) should or could be used to generate the IR signature of any specified airbreathing airborne weapon system is developed. The identification algorithm presented is in the form of an "applicability algorithm" which has the capability to generate the analysis requirements for any generic airbreathing weapon system found in military (or civilian) service. This Applicability Algorithm serves two major functions. First, it displays the ability (or suitability) of selected computer models to analyze the IR signatures of generic airbreathing weapons systems. Second, it provides a description of the computational capabilities required to reliably model a given weapon system's IR signature. All IR signature model data used in the applicability Algorithm were obtained from the developers of the included programs via mailed survey questionnaires.

Report No.:
JTCG/AS-80-C-001 (Vol I)
TR-78-25

Report Classification:
UNCLASSIFIED

Title: Infrared Emissions Analysis Utility Matrix for Inflight Aircraft - Volume I, User Manual

Issued: August 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
C. W. Stone, R. B. Edleman, P. T. Harsha, and F. G. Smith, Science Applications, Inc.

Abstract:

A means of determining which of the available IR signature model(s) should or could be used to generate the IR signature of any specified airbreathing airborne weapon system is developed. The identification algorithm presented is in the form of an "Applicability Algorithm" which has the capability to generate the analysis requirements for any generic airbreathing weapon system found in military (or civilian) service. This Applicability Algorithm serves two major functions. First, it displays the ability (or suitability) of selected computer models to analyze the IR signatures of generic airbreathing weapons systems. Second, it provides a description of the computational capabilities required to reliably model a given weapon system's IR signature. All IR signature model data used in the Applicability Algorithm were obtained from the developers of the included programs via mailed survey questionnaires.

Report No.: JTCG/AS-79-V-008

Report Classification: UNCLASSIFIED

Title: QKLOOK Computer Programs Analyst & User manuals

Issued: April 1980 Final

Sponsor:
Naval Weapons Center
China Lake, CA 93555

Performing Organization:
ASI Systems International

Author(s):
F. J. Steenrod and J. E. Musch, ASI Systems International

Abstract:

QKLOOK is a set of four FORTRAN computer programs which are used to evaluate a target's vulnerability to Directed High Energy Weapons. A target is modeled by describing the geometric shapes of its components and executing a shotline generating program. The weapon is described with intensity levels at various time intervals. QKLOOK is used to simulate the weapon effects along each shotline by computing penetration times for every encounter. The penetration distances at these computed times are used to compute probabilities of kill given a hit, P(K/H), for each component at several time increments based on component critical penetration depths. These probabilities are then used to compute time-increment-dependent vulnerable areas.

The results are expressed as presented and vulnerable areas at each time increment for components, systems of components, and the total target. This document contains information intended for both analysts and users. The first four sections contain technical descriptions of the mathematical concepts, program logic, and source program details. The last three sections contain user-oriented information needed to input the programs and interpret the resulting output.

Report No.: JTCG/AS-79-V-006

Report Classification: SECRET

Title: Survivability Analyst Guide for Soviet Naval Nonnuclear Surface-to-Air Missile Systems Characteristics (Current and Projected) (U)

Issued: 1979 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA

Author(s):
Unknown

Abstract:

(U) Threat characteristics of principal current and projected ship-to-air guided missiles are presented. These threat data inputs are for vulnerability, survivability, and effectiveness analysis in support of U.S. aircraft programs. For each missile threat discussed in the study, information is included on the characteristics of the missile system and the radar used with the missile system.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-79-V-004

Report Classification:
UNCLASSIFIED

Title: Reduction of Quantal Data of Small Sample Sizes

Issued: April 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
J. Becsey

Abstract:

In certain areas of destructive testing, test samples are exposed to various levels of stimulus or stress. In these tests, samples respond to the applied stress with either survival or failure. Most often the responses of the samples are instant or very complex and the exact level of stress causing failure cannot be measured or precisely determined. Therefore, special statistical methods must be used to reduce the test results. These methods are often limited to tests of large sample sizes. This note presents a novel data reduction method which alleviates this need and is very appropriate for those cases where only a limited number of samples are available for testing. A computer oriented approach, including a Fortran-coded and a desk calculator version, is described in detail.

Report No.:
JTCG/AS-79-C-004
TR-78-54

Report Classification:
CONFIDENTIAL

Title: Aerosol Laser Passive Countermeasures Conceptual Development (U)

Issued: May 1979 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
U.S. Army Research Test Laboratory
Ft. Eustis, VA

Author(s):
G. M. Hess, Boeing Aerospace Co.

Abstract:

(U) The purpose of this program was to investigate conceptual development and evaluate Aerosol/Smoke Systems compatible with the A-1 type helicopter that would provide a countermeasure for any weapon system that depends on visual acquisition, laser designation and laser range finding for delivery of effective fire on the helicopter. The results of established theoretical easability of a smoked countermeasure system to enhance survivability on the attacked helicopter in its anti-armor roll.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-79-C-003

Report Classification:
UNCLASSIFIED

Title: Infrared Measurement Variability Analysis

Issued: September 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Research Laboratory
Washington, D.C.

Author(s):
N. K. Matthis, T. J. Morin, and W. E. Thompson, ARINC Research Corp., Wash., D.C.

Abstract:
Two different Michelson interferometer measurement systems were used to collect spectral radiant intensity data describing blackbody emissions. These data were subjected to statistical and numerical analysis for the purpose of characterizing infrared measurement variability. A mathematical model has been postulated to describe the variability of infrared measurements based on the results of this analysis. Recommendations are made for future study to verify and extend the results presented in this report.

Report No.:
JTCG/AS-79-C-002
AFAL-TR-78-187

Report Classification:
SECRET

Title: Optical Countermeasures Effectiveness Measures Simulation - Vol I (U)

Issued: December 1978 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Wright-Patterson AFB, OH

Author(s):
G. Hetley, M. Tollin, and A. Luebcke, Quest Research Corp.

Abstract:
(U) This report presents the results of a study to develop a methodology for modeling the effectiveness of optical countermeasures in enhancing aircraft survivability against optically controlled weapons. The purpose of the report is to provide modeling techniques for evaluating measures of OCM effectiveness in the initial form of computer flow charts and guidelines.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-78-V-007
3270-88/BUF-13

Report Classification:
UNCLASSIFIED

Title: Simplified Techniques for Vulnerability Tradeoff Analyses

Issued: August 1979 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Falcon Research and Development
One American Drive
Buffalo, NY 14225

Author(s):
N. Morse, Art Stein

Abstract:

This report provides a simplified technique for tradeoff evaluations suitable for use in the conceptual design stage of aircraft survivability. Choosing from among alternative passive defense measures for reduction of terminal ballistic vulnerability would, if all things were equal, lead one to choose the measure giving the largest reduction. However, the alternative designs usually have "penalties" in cost, weight, size or performance associated with them. Decisions then require tradeoff analysis. This report describes the extension of original developments in tradeoff methodology (which were concerned primarily with cost and weight penalties) to include speed and maneuver penalties. Methods for treating mixes of missions and/or threat weapons are also described.

Report No.:
JTCG/AS-78-V-003

Report Classification:
SECRET

Title: Preliminary Design External Blast Vulnerability Assessment Procedure (Volume I, Analyst Manual) (U)

Issued: August 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Flowers, J., Bailey, R., Spann, G.

Abstract:

(U) The External Blast Vulnerability Assessment Program provides traceable and repeatable methodology for prediction of whole aircraft damage due to external blast effects from nonnuclear weapons greater than 5 pounds in explosive weight. Arrays of reference and surface points are used to describe the overall aircraft configuration. These points reflect size, shape, and position of fuselage section, wings, stabilizers, engines, etc. Structural properties of the design are automatically selected from precoded data for existing example aircraft of similar construction, or are computed from user-specified information. The threat warhead is selected from precoded descriptions of existing air-to-air and surface-to-air projectile and missile weapons, or is specified by the user. Capabilities of the program were validated by comparing computed damage with actual results observed in whole aircraft tests conducted by the Royal Aircraft Establishment, Farnborough, England.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-78-S-001

Report Classification:
UNCLASSIFIED

Title: Surface-to-Air Missile Model - MICE II (Volume II, User Manual)

Issued: 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division,
WPAFB, OH 45433

Author(s):
P. T. Chan and R. A. Huffman, Vought Corporation

Abstract:

This report provides a brief description of MICE II capabilities so that the user is aware of options open to him when he employs this surface-to-air missile engagement simulation program. The User Manual includes instructions on the application of simulation controls, input data preparation, internal data updates and printout controls. Sample problems are used to illustrate the program flexibility. Typical data input setups are provided for the simulations so that the user can employ them as a guide to data deck arrangement or as checkouts for user simulation runs.

Report No.:
JTCG/AS-78-S-001

Report Classification:
UNCLASSIFIED

Title: Surface-to-Air Missile Model - MICE II (Volume I, Analyst Manual)

Issued: 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
P. T. Chan and R. A. Huffman, Vought Corporation

Abstract:

This report describes the simulation mechanics of the Missile Intercept Capability Evaluation (MICE II) model. It provides detailed discussion regarding the model's simulation logic, equations of motion, derivation of missile guidance commands, generations of target trajectory, target miss distance calculations, effects of terrain masking, multipath radar angle masking and noise jamming on target acquisition/lock-on, and the effects of noise jamming and target intercept range on target kill probability. The report describes functional characteristics of MICE II subroutines as well as the utilization of block data provided in the model.

Report No.:
JTCG/AS-77-V-004
TR-77-9

Report Classification:
UNCLASSIFIED

Title: Military Aeronautical Systems Materials Matrix Study - Volume II, Pictorial and Tabular Presentations of Vehicle Skin Material Data

Issued: April 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Beaupain, H. P., Crowder, P. A., Wilbert, R. E., Zimmer, G. T.

Abstract:

This report presents the results of a comprehensive technical survey to identify, describe, and summarize the material composition of the external surface regions of U. S. military aircraft and to compile the associated material property and laser response data for those materials. Results are summarized in Volume I and detailed vehicle surface material definition (type, thickness area, location) is presented in volume II as a design data source.

Report No.:
JTCG/AS-77-V-003
TR-77-9

Report Classification:
CONFIDENTIAL

Title: Military Aeronautical Systems Materials Matrix Study Volume I Summary and Results (U)

Issued: April 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division, Wright-Patterson AFB, OH

Author(s):
Beaupain, H. P., Crowder, P. A., Wilbert, R. E., Zimmer, G. T.

Abstract:

(U) This report presents the results of a comprehensive technical survey to identify, describe, and summarize the material composition of the external surface regions of U. S. military aircraft and to compile the associated material property and laser response data for those materials. Results are summarized in Volume I and detailed surface material definition is presented in Volume II as a design data source.

Report No.:
JTCG/AS-77-V-001
ASD-TR-7719

Report Classification:
CONFIDENTIAL

Title: Aircraft Fuel Tank Environment/Threat Model for Fire and Explosion Vulnerability Assessment (Volume I, Data Search and Analysis) (U)

Issued: May 1980 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Air Force Aero Propulsion Laboratory

Author(s):
Mahood, L., Custard, G. H., Pascal, A.

Abstract:

(U) This report summarizes the results of Task I of a four-task program to develop an environment and threat model for fire and explosion vulnerability assessment of combat aircraft fuel tanks. An extensive literature search was performed of relevant modern and historical data, particularly on ballistic tests of actual or replica aircraft fuel tanks.

Report No.:
JTCG/AS-77-S-002
NA-76-917LI

Report Classification:
SECRET

Title: Generic Missile Warheads for use in Aircraft Preliminary Design Hardening Trade Studies (U)

Issued: September 1979 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Brennan, L.M., Darling, W., Prislow, J.

Abstract:

(U) This report summarizes the results of a survey and evaluation of the spectrum of enemy surface-to-air and air-to-air nonnuclear missile warheads. This evaluation summarized 30 enemy missile warheads, categorized them, and developed a few generic designs that can be used to represent them in aircraft preliminary design trade studies. The resulting generic warheads are intended to be used for assessment of hardening during the early preliminary design stages when limited time, manpower, and design data are available. The hardness levels derived using these missile warheads are expected to be representative of those that will result during later, more detailed assessments of the designs. This procedure will allow hardening considerations and incorporation of desired hardness levels early in the design cycle. The generic warheads are intended to be used to develop hardening guidelines; they are not intended to be used to accurately represent vulnerability to each specific missile type.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-77-S-001

Report Classification:
UNCLASSIFIED

Title: An Examination of Selected Digital Flightpath Generators

Issued: November 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
NWSC Division
Crane, IN

Author(s):
N. Papke

Abstract:

This report describes the findings of an investigative analysis of four flight path generation computer models. The four models (FAIR PASS, FLYGEN, BLUE MAX and MCEP) are commonly used in the aircraft survivability/vulnerability community. The first three are primarily fixed-wing models, while MCEP is exclusively a rotary-wing flight path generator. All four models were acquired, installed, tested, and analyzed at the NWSC. Criteria such as capabilities, limitations, ease and economy of use, and compatibility with attrition models were considered in the evaluations.

Report No.:
JTCG/AS-76-V-006

Report Classification:
UNCLASSIFIED

Title: Failure Prediction for Damaged Aircraft Structures

Issued: 1976 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
William J. Stronge

Abstract:

A general method is presented for assessing the effects of aircraft structural damage. Analyses of damaged structures subjected to flight loading conditions are used to determine the residual performance envelope of any particular aircraft. By comparing the residual performance with required performance for a particular mission scenario, kill levels can be established for any prescribed damage.

Report No.: JTCG/AS-76-V-004

Report Classification: UNCLASSIFIED

Title: Aircraft Vulnerability Assessment Methodology Volume 1 - General

Issued: July 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Ballistics Research Laboratory
APG, MD

Author(s):
D. W. Mowrer, R. D. Meyerhofer, and R. N. Schumacher

Abstract:

This report is being published in twelve volumes. Volume I presents the general problems of aircraft vulnerability assessment and the methodologies currently being used in vulnerability studies. Volumes II through XI present discussions of the vulnerability of each of the aircraft systems to nonnuclear threats, procedures used for assessing the vulnerability test data for various components, and existing vulnerability data gaps. Volume XII contains a bibliography of published reports (mainly by Army agencies) pertaining to the vulnerability of aircraft and the methodology for assessing the vulnerability of aircraft.

Report No.: JTCG/AS-76-S-004

Report Classification: UNCLASSIFIED

Title: MISDEM Computer Simulation (Volume II, Analyst Manual)

Issued: 1976 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
G. L. Gallien and S. C. Silver, Rockwell Intn'l LA A/C Div.

Abstract:

MISDEM is a S/V model that transforms aircraft subsystems probabilities of survival into probabilities of aircraft survivability and probabilities of various aircraft response modes, such as flight, countermeasures, and weapon delivery modes having different degrees of effectiveness. The model may be used to compute measures of effectiveness, such as numbers of targets killed in a mission or a campaign. It is intended for use in measuring the impact of vulnerability of subsystems on aircraft survival and effectiveness for unenhanced or protected subsystems. This analyst manual contains: (1) a description of the mathematical model and its potential applications, (2) a description of the computer code and its derivation, and (3) a listing of the simulation program and test cases used for program verification (which are described in the User Manual).

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-76-S-003

Report Classification:
UNCLASSIFIED

Title: MISDEM Computer Simulation (Volume I, User Manual)

Issued: July 1979 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Warfare Center, Weapons Division
China Lake, CA

Author(s):
G. L. Gallien and S. C. Silver, Rockwell International

Abstract:

The MISDEM (Mission/Damage Effectiveness Model) transforms aircraft subsystem probabilities of survival into probabilities of aircraft modes of response, such as evasion, countermeasures, and weapon survival into probabilities of aircraft modes of response, such as evasion, countemeasures, and weapon delivery modes having different degrees of effectiveness. The model probabilities may then be used in higher order models that compute measures of effectiveness and cost. This user manual contains: (1) a detailed description of the variables required to execute the program and the proper order of the input deck, (2) a detailed description of the output, complete with definitions of the printed data, and (3) a sample case.

Report No.:
JTCG/AS-76-S-002

Report Classification:
UNCLASSIFIED

Title: The Mission Trade-Off Methodology (MTOM) Model: User's Manual

Issued: October 1978 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division,
WPAFB, OH 45433

Author(s):
A. T. Kearney & Co./Caywood-Schiller Division

Abstract:

The MTOM programs provide a means for evaluating the relative cost-effectiveness of proposed aircraft modifications for the purpose of enhancing survivability. The model can treat a wide variety of aircraft and scenarios. There are two programs. One (MTOM) performs the effectiveness analysis. The other (MTO/C) provides the costing. This manual is designed to enable the user to prepare the inputs for the MTOM programs. It covers the overall organization, input formats and restrictions, limitations, and outputs. This document, the MTOM User's Manual, is presented as a companion volume to the Mission Trade-Off Model (MTOM): Model Description, which contains the theory and rationale behind MTOM.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-76-S-001

Report Classification:
UNCLASSIFIED

Title: The Mission Trade-Off Methodology (MTOM) Model: Model Description

Issued: February 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
A. T. Kearney & Co./ Caywood-Schiller Division

Abstract:

Presented are the results, assumptions and rationale of model to evaluate the relative cost-effectiveness of proposed aircraft modifications for survivability enhancement. Two primary questions are addressed. How effective are the proposed modifications in a mission context and what are the important factors contributing to the improvement? To answer these questions, the MTOM model was developed. Parametric variations are presented and analyzed. This report is directed to the analyst who wishes to understand the details of the model. Parametric includes heuristic development of these details.

Report No.:
JTCG/AS-76-CM-001

Report Classification:
Vol I & II - SECRET, Vol

Title: Countermeasures Handbook for Aircraft Survivability (U)

Issued: February 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Air Force Systems Command
Washington, D.C.

Author(s):
Philip Sandler, AFSC, AAFB and Marcellus R. McLaughlin and Parlan L. McGivern, Telcom Systems, Inc.

Abstract:

(U)This handbook provides a comprehensive, timely, and accurate publication on those aspects of electronic warfare that relate to aircraft survivability. It is intended to be tutorial in nature for the use of electronic warfare staff personnel, technicians, tacticians, operators, and for some applications electronic warfare designers. It should also be remembered that this is a compilation by individual contributors and as such, portions of some chapters may tend to reflect differing viewpoints. This handbook reflects current (as of 1976) electronic warfare technological advances and state-of-the-art that have transpired since publication of the U.S/ Army sponsored Electronic countermeasures book in 1961.

(U) An update to this Handbook has been published (JTCG/AS-93-S-001).

Report No.: JTCG/AS-75-V-004

Report Classification: CONFIDENTIAL

Title: Vuln. of A-7E Aircraft to Selected Nonexplosive Proj. Threats (U); Volume I - Analysis Input Data and Geo. Model Desc. (U); Volume II - Vuln. Area Analysis

Issued: February 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA

Author(s):
M. C. Mitchell and D. G. Tauras

Abstract:

(U) This report comprises two volumes, each under separate cover. Volume I contains all analysis input data and information and A-7E geometric model description. Volume II contains the complete and detailed vulnerable area analysis results. A-7E vulnerable areas were computed for 26 aircraft attack aspects with threat impact velocities ranging from 500 to 3500 ft/sec. The threats considered were four small arms Soviet ground-to-air armor piercing incendiary projectiles. The analysis shows that the A-7E does not fully exploit the vulnerability reduction features offered by the present state-of-the-art. The vulnerability of the A-7E to threats considered can be reduced by installing: (1) Internal foam in all fuel tanks, (2) void-filling (where possible) around all fuel tanks, (3) .50 caliber bottom and side armor around cockpit, and (4) .50 caliber bottom and side armor around engine.

Report No.: JTCG/AS-75-V-003
73106-50

Report Classification: CONFIDENTIAL

Title: Vulnerability Analysis of the A-4M and AV-8A Aircraft to Selected Threats (U)

Issued: December 1976 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Naval Air Development Center
Warminster, PA

Author(s):
M. C. Mitchell and D. G. Tauras

Abstract:

(U) This report describes the vulnerability analysis of the A-4M and AV-8A aircraft. Vulnerable areas are developed for the six major attack aspects of each aircraft. The selection of the threats, kill level, and aircraft configuration was based on the results of other analyses previously performed in the close air support area, thus making these analyses compatible.

JTCG/AS BIBLIOGRAPHY

Report No.:
JTCG/AS-75-S-001

Report Classification:
UNCLASSIFIED

Title: Error Analysis of Presented Area Computation Techniques

Issued: June 1977 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Aeronautical Systems Division
WPAFB, OH 45433

Author(s):
Smith, R. B.

Abstract:

This report uses the rectangular and ellipsodial projection techniques to convert six cardinal views into 26 views for attrition modeling purposes. Also included are presented area computation techniques.

Report No.:
JTCG/AS-74-T-009
BRLITB-T-541

Report Classification:
CONFIDENTIAL

Title: Vulnerability Tests on Operating Power Train Components of an Intermediate-Size Helicopter (U)

Issued: September 1974 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Ballistics Research Laboratory
Aberdeen PG, MD

Author(s):
Thompson, Walter S.

Abstract:

(U) Presents results of 14.5- and 23-mm AP projectile firing tests against the forward, central, and aft transmissions, drive tubes, end fittings, and hanger bearings of CH-21 aircraft operated under power in a tied-down configuration.

JTCG/AS BIBLIOGRAPHY

Report No.:
AFWAL-TR-87-3114

Report Classification:
CONFIDENTIAL

Title: FASTGEN/COVART Sensitivity Study (U)

Issued: February 1988 Final

Sponsor:
Wright Laboratory

Performing Organization:
Wright Laboratory
Flight Dynamics Directorate
WPAFB, OH 45433

Author(s):
Andrew M. Pascal

Abstract:

(U) The use of analytical vulnerability assessments in quantifying the vulnerability of aircraft in combat and for providing inputs into survivability assessments of aircraft is an accepted procedure and plays a major role in the development and acquisition of USAF weapon systems. One such method, known as the FASTGEN/COVART methodology is used to determine an aircraft's vulnerability expressed in terms of vulnerable area. The work discussed in this report is concerned with a sensitivity study to determine how and to what degree the different inputs affect the generated vulnerable area. The results of this sensitivity study form the basis for development of a plan to improve both the use of the COVART methodology and the methodology itself. A comparison between analytically and empirically derived vulnerable areas was to validate the FASTGEN/COVART methodology.

Report No.:
WL-TR-92-4039

Report Classification:
UNCLASSIFIED

Title: Joining and Repair of Heat Resistant Composites

Issued: August 1992 Final

Sponsor:
Wright Laboratory

Performing Organization:
Wright Laboratory
Materials Directorate
WPAFB, OH 45433

Author(s):
Jerome J. Connolly; Mr. Frank Fechek, WL/MLSE

Abstract:

This report presents the progress on the Joining and Repair of Heat Resistant Composites Program for the period of April 1989 to March 1992. The program objective is to examine new materials, processes and equipment for their applicabiity to high temperature composite repair development. This interim technical report is primarily concerned with describing accomplishments achieved in Tasks 1 and 2.

Report No.: FR-A4950

Report Classification: UNCLASSIFIED

Title: Digital Infrared Seeker and Missile Simulations (DISAMS) and Related Software

Issued: February 1992 Final

Sponsor:
Naval Research Laboratory
Code 5631
4555 Overlook Ave., SW
Washington, DC 20375-5000

Performing Organization:
Georgia Tech Research Institute
Georgia Institute of Technology
Atlanta, GA 30332

Author(s):
Dr. Frank Barone, NRL sponsored this publication which was published by GTRI under contract #N00014-87-K-2038 - No Report Documentation Page

Abstract:

This document describes work performed under contract N00014-87-K-2038 for the Naval Research Laboratory (NRL). The technical monitor was Dr. Frank Barone. This final report is somewhat unusual in that the work it describes was performed primarily under this contract, but relatively small portions of it were supported by other contracts as well. No attempt has been made to separate these contributions because in most cases that would be extremely difficult if not impossible. The software described here is evolutionary in nature. In every case, the initial work was performed for NRL, but improvements have been supported by other government agencies from time to time, and those changes are often further modified with additional NRL support. The document itself is currently used as the User's Manual for the DISAMS (Digital Infrared Seeker And Missile simulation) and ISAMS (Imaging Seeker And Missile Simulation) series of missile models and it, or a specialized modification of it, is delivered with each of the models. As new features are added to the software tools described in the manual, the document is modified to reflect those changes and updates of the relevant portions are provided to users.

Report No.: WL-TR-92-1089

Report Classification: SECRET NOFORN/WNINTEL

Title: Air-to-Air ARM Countermeasures Program (U)

Issued: June 1992 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
Avionics Directorate
WPAFB, OH 45433-7311

Author(s):
Robert Dunning, Nick Mazzariello, George Turner, Joe Cikalo

Abstract:

(U) The Air-to-Air ARM Countermeasures Program, Contract F33615-88-C-1736, had three objectives:
(U) 1. Analyze the vulnerability associated with a specific Air-to-Air ARM and develop candidate countermeasures to provide protection for U.S. aircraft.
(U) 2. Specify, design, and fabricate an Electronic Countermeasures (ECM) breadboard which can generate the required ECM techniques with variable parameters.
(U) 3. Evaluate the effectiveness of these techniques versus a missile seeker with comparable performance.
(U) This final Report summarizes details of the threat vulnerability assessment, hardware development, system performance, and effectiveness evaluation.

JTCG/AS BIBLIOGRAPHY

Report No.: **Report Classification:**

AFWAL TR-84-3119 **UNCLASSIFIED**

Title: Powder Pack Fire Protection for Aircraft Dry Bays

Issued: 1 June 1985 Final

Sponsor:
JTCG/AS Central Office
Crystal Gateway #4, Suite 1103
1213 Jefferson Davis Highway
Arlington, VA 22202

Performing Organization:
AFWAL/FIES
Air Force Wright Aeronautical Laboratories
Wright-Patterson Air Force Base, OH 45433

Author(s):
Seymour, T. J.; Ellenwood, P. S.

Abstract:

This paper discusses the ballistic evaluation of powder packs as a fire protection scheme for aircraft dry bays adjacent to fuel cells. Powder packs were tested in the leading edge dry bay of a replica aircraft wind and in a replica fuselage dry bay against both armor-piercing incendiary (API) and high-explosive incendiary (HEI) projectiles. Several variables such as airspeed, hydraulic lines in the dry bay, and different extinguishing powders were evaluated to determine their impact on the fire extinguishing capability of the powder pack concept. Testing to date has shown that powder packs offer reliable fire protection for aircraft dry bays at a weight savings of more than 80 percent over solid-packed rigid foam, in some configurations.

Report No.: **Report Classification:**

NAWCWD TP 8462 **Unclassified**

Title: The F/A-18E/F Live Fire Test and Evaluation Program: A Comprehensive Summary (U)

Issued: March 2000 Final report 1987-1999

Sponsor:
PMA-265 (AIR-4.1.1),
Office of the Secretary of Defense (OSD),
Deputy Director of Operational Test and Evaluation,
Live Fire Test (DOT&E/LFT)

Performing Organization:
Naval Air Warfare Center Weapons Division
Code 418300D
China Lake, CA 93555-6100

Author(s):
J. Hardy Tyson, Charles E. Frankenberger, and susan L. Hennigan

Abstract:

(U) This document presents a comprehensive summary of the F/A-18E/F Live Fire Test (LFT) Program. LFT began in 1993 and culminated with the completion of SV52 Live fire Tests in December 1999. Testing was sponsored by PMA-265 (AIR-4.1.1).

Susceptibility Reduction Index

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Susceptibility Reduction Index

Susceptibility Reduction Index

Susceptibility Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Vulnerability Reduction Index

Survivability Methodology Index

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